REPORT

OF

A COMMITTEE FOR THE INVESTIGATION

OF THE

COAL AND MINERAL RESOURCES OF INDIA,

FOR MAY, 1845.

BY THE SECRETARY.

CALCUTTA:

W. RIDSDALE, BENGAL MILITARY ORPHAN PRESS.

1846.

CONTENTS

GENERAL PROCEEDINGS,

The 28th December, 1836.

THE growing importance of the line of Iron Steamers established for communication between Calcutta and Allahabad, renders it essential to consider again the means of providing Coal for their use. Resolution.

At present the Mines of Burdwan present the only resource available for the entire demand of this Presidency, and their produce reaches Calcutta by an uncertain and difficult navigation down the Damoodur, a mountain torrent which, for more than half the year, is entirely closed. During that period the Coal remains in Depots at Ampta, whence it is forwarded into the Hoogley river in different craft from that in which it was brought to Ampta as required. The Depots along the Ganges are now uniformly supplied from this source and are hence subject to all the uncertainty of the navigation of the Damoodur, and in case the demand for Coal at the Presidency should be more active at any time than was expected the Depots at Ampta are exhausted, and the whole supply of the capital and of the interior is at a stand until the Damoodur is again filled on the setting in of the rainy season.

This difficulty actually occurred in the past season, and great disappointment was accordingly experienced in the upper stations of the Ganges in particular, which did not receive the supplies for their Depots till long after they were required.

Such accidents will be occurring constantly as the inevitable consequence of the entire supply of Coal being drawn as at present from one spot. The Government, however, has knowledge of other Mines in various parts of the territory of this Presidency more conveniently situated than the Burdwan Mines for the purposes of Steam Navigation, and the Governor of Bengal cannot believe that means may not be found of bringing these resources also into play. The subject has heretofore attracted the attention of Government, and individuals have from time to time been deputed to search for Coal in different quarters, and their reports have been recorded showing their enquiries to have been attended with various success. When these enquiries were ordered the subject had not the same importance as it now possesses, under the assurance of success to the project of navigating the Ganges extensively with Iron Steamers of small draught, and the results of the several enquiries have

never been combined for the definite purpose of showing where the endeavour to bring the Coal resources of the interior into use can be prosecuted with most chance of ultimate success.

Mr. Surgeon Wm. Banister.
Captain J. H. Johnston.
Captain W. N. Forbes.
James Prinsep, Esq.
Captain H. B. Henderson.

Preparatory to adopting any definite measures with this object in view, the Governor of Bengal resolves that the Gentlemen named in the margin shall be appointed a Committee, specifically to consider all the information on the subject now collected at the Presidency, and to recommend what further examinations or surveys shall be ordered for the purpose, enabling Government to decide as to the best means of procuring Coal applicable to the wants of Steam Navigation in the Interior. The enquiries of the Committee will embrace as well as the locality of the different Mines of Coal explored as the descriptions of the mineral, and whether it is found alone or with Iron lead of Copper, or other useful metals in the vicinity of the Mines, and likewise by what routes and at what expense in their improvement or construction it will be possible to bring the Coal to the banks of navigable rivers.

True Copy,

(Signed) H. T. PRINSEP,
Secy. to Govt.

LIST OF COMMITTEE FROM COMMENCEMENT.

PRESIDENTS.

C. W. Smith, Esqr., C. S., ...	Member of the Sudder Board of Revenue and Provisional Member of Council. Date of Appointment 17th April 1839. Date returned to Europe 4th May 1842.
J. W. Grant, Esq., C. S., ...	Keeper of the Export Warehouse and Member of the Marine Board. Date of Appointment 10th June 1842.

MEMBERS

James Prinsep, Esq., ...	Assay Master. Date of Appointment 28th December 1836. Returned to Europe October 1838.
Lieut.-Col Forbes, Engineers,..........	Mint Master. Date of Appointment 28th December 1836.
Major Henderson, ...	Deputy Auditor General. Date of Appointment 28th December 1836. Retained April 1839.
Captain J. H. Johnston, ...	Controller of Steam Vessels. Date of Appointment 28th December 1836.
W. Bannister, Esq., ...	Madras Medical Service. Date of Appointment 28th December 1836. Returned to Madras February 1837.
J. McClelland, Esq., ...	Bengal Medical Service, Junior Member and Secretary. Date of Appointment 24th March 1837.
*W. Cracroft, Esq., C. S., ...	Judge of the Sudder Dewany Adawlut. Date of Appointment 10th May 1837. Returned to Europe 1839.

* Mr Cracroft acted as President at the request of the Members, though he stood appointed merely as Member.

Lieut.-Col. Presgrave, ...	Superintendent Cossipore Foundry. Date of Appointment 17th April 1839. Proceeded to the Cape 7th December 1840.
Captain A. Wilson, ...	Superintendent Cossipore Foundry. Date of Appointment 7th December 1840.
Major W. R. FitzGerald, Engineers,	Superintendent Engineer of the South Eastern Provinces. Date of Appointment 10th June 1842. Deceased November 1844.
Thomas Cargill, Esq., ...	Date of Appointment, 16th April 1845.



No. 1.

I. INTRODUCTION.

1 Agreeably with the preceding Resolution Dr Bannister, acting as Secretary of the Committee, had just time to collect and place in the hands of the Members such documents as were available in the public offices bearing on the proposed enquiry before he was recalled to Madras, to which Presidency he belonged.

In 1838 the Committee lost the services of Mr James Prinsep.

In 1839 the Committee were likewise deprived of the services of Mr Cracroft and Major Henderson,—these vacancies were afterwards filled by C W Smith, Esq, as President, and Colonel Presgrave

On the retirement of the former in 1842, and the death of Col. Presgrave, J W Grant, Esq, succeeded as President, and the late Major W R FitzGerald as Member, whose death shortly after took place

2 The first Minute in the Committee was written by Captain Forbes, 4th May 1837 It directed that the Secretary should draw up the first Report consisting of an Historical and Topographical as well as Geological account of all that was known up to that period, of the existence of Coal and Iron in India. It further directed that such information should be conveyed in a popular form, with a view to ultimate publication

This was countersigned by Captain Johnston and Mr J Prinsep, and directed to be recorded for the guidance of the new Secretary, who was referred to the papers in the Committee box, as well as to several Reports in public offices for his materials.

3 Captain Henderson instead of subscribing to the above remarked, that if the papers in the Committee box were to be taken as a sample of the practical *information to* be found *in public offices, they would have to rely more on the* experience of their Secretary, and the information to be elicited in correspondence with the authorities located where Coal is known to exist, than on any materials already in possession of Government, particularly as no previous enquiry had ever been entered on with the specific object now in view, except by the late Mr William Jones. The results of whose proceedings were already before the public.

4 Captain Henderson then enumerated the following localities where Coal was known to exist, but regarding which we had little information, with the exception of what was published by Mr Jones regarding Burdwan.

1 Burdwan.
2 Cherra Ponji and Laur

3. Hurrah and Baglepore.
4. Mootee Jarma near Sukreegullee, and Rajmehal.
5. Palamow and on the Coile River.
6. Bidgeghur.
7. Vicinity of Hazareebag and the Benares Road.
8. (Assam) under the Naga Hills, Dysung Nuddee and vicinity, worked by Mr. Scott.
9. (Assam) on the Namroop River.
10. (Assam) the bank of the Jomuna.
11. (Assam) the Noa Dihing and its affluent the Dupha Panee.
12. The Coal formation supposed by Captain Jenkins to extend to the western extremity of the Curribari Hills near the great bend of the Barrampooter.

5. The first Report conformably with the plan laid down by the Members in the Minute of Captain Forbes above referred to, was submitted to Lord Auckland 18th October 1837. It was soon after ordered to be printed to the extent of 250 copies and distributed.

Three years and a half afterwards, 14th April 1841, the subsequent proceedings of the Committee having come under the observation of the Governor General, His Lordship caused the following memorandum in his own hand to be conveyed to the President of the Committee through the Private Secretary Mr. Colvin.

" These Reports are satisfactory, and much that is useful is apparently in progress and promising well—I shall presently hope for such a Report as may give a good summary of all that has been done, and as may be sent home and published here. It would I think be much to the credit of the Committee."

A second more copious Report was accordingly prepared by the Secretary, containing an abstract of the monthly proceedings of the Committee, with *all the* results attained up to April 1841. It was ordered at once to be printed and distributed to the extent of 250 copies.

In April 1842 a continuation of the proceedings up to that date was also printed and distributed amongst the Mercantile Houses of Calcutta.

But it was not until the present time that such a summary as the Governor General called for, could be completed in a manner at all becoming the nature and importance of the subject. If the delay that has taken place be thought excessive, it ought to be remembered as some excuse for the Committee, that its enquiries relate to great practical questions upon which we had no previously existing experience in India to guide us.

6. The total outlay on account of the Committee from its institution January 1837 to January 1845, being a period of eight years, has been Co.'s Rs. 19617 6 0.

Of which sum the following items stand on the credit side:—

To Books and Office Furniture, Rupees	528	2	8			
„ Mining Tools, Rupees	886	1	6			
„ Blast Furnace, erected at the Mint, ...	1945	10	0			
„ Adji Iron Stone, sent to the Mint, ...	396	7	0			
„ 500 Maunds of Lime Stone, sent to the Mint, .	250	0	0			
„ 6906 Maunds of Coal delivered to different Public Establishments, ...	3202	11	4			
Deduct, ...				7209	0	6
7. Leaving a total expenditure of Rupees				12408	5	6
Which sum, Rupees	4616	10	8			
Was devoted to 21 months and 5 days Secretary's Salary as follows						
To Secretary's Salary from 25th March to 15th December, 8 months and 20 days, at 100 Rs. per mensem, Rupees	866	10	8			
„ Ditto Ditto from 15th December 1837 to 15th December 1838, being 1 year, at 300 Rupees per mensem, Rupees	3600	0	0			
„ Ditto Ditto from 15th December 1838 to 1st February 1839, being 1 month and 15 days, at 100 Rupees per mensem, ...	150	0	0			
Deduct, ...				4616	10	8
				7791	10	10
8 Of this balance, Rupees	3630	5	2			

Have been expended in Mineral Surveys as follows:—

To Lieut. Don, for travelling charges, proceeding to examine the Coal at Sukree Gully, Rupees	83	5	9			
Ditto ditto, ...	83	5	9			
To George Osborne, Esq., for travelling charges, proceeding to examine the supposed Coal at Bidgeghur, ...	240	0	0			
„ Mr Tonkin, a Coal Miner, employed in Arrakan 3½ months, at 100 Rupees per mensem,	350	0	0			
„ Captain Bogle, Commissioner of Arrakan, for expenses incurred in searching for Coal, ...	721	9	3			
„ Mr. L. Fleming, a Coal Miner, employed at Rajmehal 2 months, at 50 Rupees per mensem, 100, at Curribari, 10 months and 22 days, at 70 Rupees per mensem, 748-12-0,	848	12	0			
Carried over......				12408	5	6

		Brought forward	12408 5 6
To Mr. Sweetland, to enable him to produce samples of Curribari Coal as proposed by himself on the assurance of his personal knowledge of its value,		1387 10 2	
		Deduct,	3631 5 2
		Balance,	4160 5 8
9. To Postage, Rupees	298 6 0		
„ Freight and Banghy Charges,	47 9 0		
		345 15 0	
„ Printing extra copies of first Report,		161 10 0	
„ Ditto ditto 4 cancelled pages, 2d Report.... 1841,		10 10 8	
		Deduct,	518 3 8
Total expense of Committee for petty Charges, Stationery and Establishment, from January 1837 to January 1845,			3642 2 0

10. In addition to the charge of Rupees 3630-5-2 in the above account for enquiries regarding Coal, the expense attending the temporary employment of Messrs. Homfray and Landers might also be included, although their bills were not submitted to the Committee for Audit. There is nothing on the records of the Committee to shew that Mr. Homfray's Deputation to Palamow emanated from it, except the following observation in the letter of the Committee to Lord Auckland on submitting the first Report of its proceedings 18th October 1837. "With your Lordship's concurrence our first measure was to depute a professional miner, Mr. Homfray, to survey and report on the Palamow Coal beds, &c."

The employment of Mr. Homfray would therefore seem to have taken place before any regular proceedings were entered upon, I mention this particularly as it has been since alleged that his interests in Burdwan Mines, were opposed to the successful object of his Mission.

11. The appointment of Mr. Landers has tended to shew that practical experience acquired in English Coal Mines, when removed to circumstances so totally different in India, may fail to answer the desired expectation.

12. With regard to the Miners B. Tonkin and L. Fleming, who were employed with a view of supplying the demand for practical aid, which was supposed to be alone required in order to open Coal Mines. Tonkin lost his health before entering on his duty and was forced to return to England. Fleming proved of some use to Mr. Erskine in opening his Mines on the Adji.

Where all the necessary previous information is obtained, and nothing remains but to commence operations such men are useful, but in India where the Geology of

the country is unknown and the districts in which Coal occurs are unsurveyed, men of superior attainments and zeal appeared to be essential in order to promote effectively the objects of this Committee

13 Hence in order to give these objects a specific and practical character, as well as to place the enquiry on a sound footing, consistent with its importance to the general interest of the country, the Committee ventured to recommend a Geological Survey of the Coal formation of India, or at least that this question should be referred to the highest scientific authorities in England

This recommendation we believe has gone home approved by the Government of Bengal, and whatever the result may be, the public interests must profit by the reference

NOTES

I have collected from the Government Offices all the papers on record respecting Coal, and they are contained in two bundles now circulated The large bundle was received from Mr Mangles, and the small one from Mr Prinsep, and to prevent confusion, gentlemen will be good enough to keep them separate

Each gentleman will have the kindness to forward the box to the next upon the list, and the last will be good enough to send it to me After the papers have been circulated, perhaps it will be better to call a meeting

(Signed) W. BANNISTER

January 18*th*, 1837

To Captain J H JOHNSTON
" Capt W N FORBES
" JAMES PRINSEP, Esq
" Capt. B H HENDERSON

Buchannan's Reports Southerland's on the Rajmehal and Bhaugulpore Hills, and many other Reports of a general nature, are amongst the Records of Government, and ought to be read and abstracted, in so far as they relate to Coal and Iron for the Committee's Report, and I would suggest the expediency of the Secretary making an official application for those Reports in the name of the Committee Buchannan's Reports I have ascertained are in the Office of the Secretary to Government in

Original Minutes regulating and fixing the duties of the Secretary

the General Department, and Southerland's in the Office of the Secretary to the Government of Bengal, and both will readily be made over to us, or our Secretary When such application has been sanctioned, the Reports of Pemberton, Jenkins, Wilcox and other Officers on Assam, Munipore, &c., and generally all the Reports in the possession of Government containing matters respecting Coal and Iron, or other minerals ought also to be similarly obtained and abstracted The first Report of the Coal and Iron Committee should contain an Historical and Topographical as well as Mineralogical account of all that is known, or can through its means be ascertained on the subject of the minerals of India thus as much as possible in a popular form, with a view to its ultimate publication, and as a means of attracting Indian or other capital to the speculation of working mines in the localities indicated. If the Members of the Committee approve of this suggestion they perhaps will have the goodness to correct and sign this memorandum as a guide to the exertions of the Secretary May 13

(Signed) W N FORBES.

Mint, May 6th, 1837.

I entirely concur in Capt. Forbes' suggestions, on which our Secretary had better act at once

(Signed) J PRINSEP.

I believe the suggested measure will be productive of great good.

(Signed) J. H. Johnston.

Major Henderson's Minute.

These Reports and any others which can be discovered in the Government Offices will be of use certainly in preparing an historical or other account of the discoveries, and may possibly serve to direct attention to new and likely situations in which to prosecute further enquiry. But, if we take the Correspondence and Reports now circulated in this box, as a sample of the practical information to be derived from any existing Records of Government, we may conclude that little useful or practical benefit will follow the task of going through the papers which the Offices have still to furnish us with.

The fact seems to be that no previous enquiry has ever had the precise practical object in view (viz. that of working and supply) which the Government have now taken up, if we except Jones' Enquiry; and it strikes me that our new Secretary whose services I am glad have been secured to us, may at once, in addition to the proposed collection of former researches, place himself in communication with the authorities and persons connected with, or in the vicinity of the places where Coal has been discovered, and endeavour to obtain such matter-of-fact information regarding the whole of them, as may determine the Government where to direct their aid and attention, and may assist speculators in coming forward to work the places themselves. May, 1837.

(Signed) H. B. Henderson.

Reports of the Committee that have been printed from time to time since May 1837.

1. Reports of a Committee for Investigating the Coal and Mineral Resources of India, 8vo. G. H. Huttmann, Bengal Military Orphan Press, 1838.

2. Reports and Abstracts of the Proceedings of a Committee for the Investigation of the Coal and Mineral Resources of India, brought up to May 1841, by the Secretary. G. H. Huttmann, Bengal Military Orphan Press, 1841.

3. Abstract of the Proceedings of a Committee for the Investigation of the Coal and Mineral Resources of India, brought up to April 1842. G. H. Huttmann, Bengal Military Orphan Press, 1842.

These being now out of print, a revised and incorporated copy of the whole should be printed, together with the latest information on the subject now submitted in the present Report May 1845.

II. LEVELS OF INDIAN COAL FIELDS.

14 No Barometrical or other measurements, with a view to obtain the relative levels and accessibility of the Coal Districts of British India, have as yet been made Improved means of transport, whether by land or water carriage, will mainly depend on such information

15 The face of the country rises gradually from the Hoogley towards Burdwan, which is proved by the fact noticed by the late Mr Jones, that at Omptah, 22 miles west of Calcutta. The tides in the Damooda, derived from the estuary of the Hoogley, rise only ten inches during the highest springs in June, ebbing and flowing only half an hour In Calcutta, on the other hand the same distance from the Sea as Omptah, there is a difference of 17 feet during the same springs, between high and low water. Hence, we infer that the rise of the country westward of Calcutta, for a distance of 22 miles to Omptah, is about 9 inches per mile Beyond this the country is known to rise more rapidly for a distance of sixty or eighty miles to the Coal Mines, which accounts for those violent floods which render the navigation of the Damooda above Omptah so difficult.

16 It may be supposed that the general rise of the face of the country from Omptah to the Coal Mines, a distance of 80 miles, is about 3 feet 4 inches per mile, so far as we can venture to judge from the little we know of the peculiar difficulties of the navigation of the corresponding portions of the Damooda, and Adji Rivers.

Thus the elevation of the Burdwan Coal District may be supposed to be about 300 feet above the sea But it may be suggested as a very important practical question, whether the best description of Coal is reasonably to be expected in the Burdwan and Adji Coal Fields, without either advancing further into the hills than the situation of the present Mines, or sinking to a proportionately greater depth, see para. 26

17 With regard to the Orissa District in which the Coal Fields of Talcher and Hingolie are situated, no particular mention is made of the existence of any very formidable rapids, in the accounts we have of the Brammi River

This River is said to be navigable for 300 maunds boats during six months of the year, from the Coast at Hunsooa, to within 23 miles of the Coal District, the whole distance being about 120 miles.

It may therefore be supposed that the Coal Districts of Talcher and Hingolie, are about 150 to 200 feet above the sea

18 Again we may suppose from the only information we have on the subject, that the Rajmehal Coal beds, situated at Doobradgepore, within 10 miles of water carriage in the rains (by means of the Burmany Nulla to Moorshedabad,) are not more elevated than the Adji and Burdwan beds. The adjoining Coal beds to the north of Doobradgepore, at the pass of Patchwarry, on the Bansli River, may be a little higher

19. The valley of Palamow contains Coal at two distinct levels, to the first of which the Coile River is partially navigable with some slight difficulty. The lower beds of Palamow Coal, may therefore be supposed in regard to levels, to bear the same relation to the Ganges at Dinapore, as the Burdwan District bears to the Hoogley at Calcutta. The second, or Upper Coal Field of Palamow valley is some hundreds of feet higher, cut off from the Lower Coal Field by an intervening ridge 500 feet high, but no exact measurements have been made. From all we know of this last Coal Field, we should suppose the height to be about 5 or 600 feet above the level of the sea.

20. With regard to the Coals at Sohagepore and Singrowlie, these beds being situated above the falls of the Sone, water carriage to any great extent is out of the question. But their distance from the Ganges at Chunar, being such as to enable the country people, without roads, to bring in Coal for sale at eight or ten annas per maund to Chunar and Mirzapore, it deserves to be considered whether the supply might not be much improved on the higher parts of the Ganges from these sources.

21. East of the Ganges, circumstances as regards the general levels of the country are different, as well as the quality of the Coal itself, which is almost invariably superior to any of the beds on the western side, except Hazareebaugh, Sohagepore and the Nerbudda Coals, as accounted for para 26.

The Coal from the Eastern Districts generally belongs to what is called Mountain Coal, the disruptive forces to which the strata in this direction have been subject, having brought up to the surface, the Main Coal, without the trouble of sinking for it.

22. The chief beds extend along the south side of Assam, at intervals from the Garrow Hills to the farthest extremity of the valley; and from the former point southward, along the eastern boundary of Sylhet to Chittagong. The Coal formation throughout this course, skirts the base of the lower ranges of hills, more or less elevated from the plains, but rarely appearing near the summit of the higher Mountains except at Cherra Ponji.

23. In Assam, as far as we are acquainted with the circumstances of the various beds, they would seem to be from 200, to 300 feet above the adjacent portions of the Barrampooter, from which they are distant generally from 40 to 60 miles by navigable tributaries.

24. The nearer situation of the Cherra Coal to the Presidency, has directed attention chiefly to it, notwithstanding its great elevation above the plains, and the consequent expense and difficulty of its delivery. Indications have been found at more accessible heights in the same vicinity, but the requisite intelligence has not yet been brought to bear on their examination, in order to determine their real value.

25. On both sides of the Ganges the Coal measures are associated with sandstone, shale, and sometimes limestone, disposed along the flanks of Hills and Mountains, the central masses of which are granite, presenting outbursts at intervals, forming more or less prominent elevations. One of these elevations on the western side, at the head of the Burdwan Coal Field, is Purrisnath, which rises it is supposed, to 5000 feet, while the adjoining country consists of low table land.

On the eastern side, the elevations are higher; and form continuous ridges affording delightful climates suited to the cultivation of European productions. For the better understanding of these observations we beg to refer to the annexed sketch, exhibiting a general section of Coal Districts from Cutch to Assam.



a, a, & c Coal Formation,—c, c, & c Primitive Rocks,—n, n, & c Basaltic and Trap Rocks—c, e, Sandstone Formation.

A, Cutch,—B, Nerbudda,—C, Sohagepore,—D, Singrowlee,—E, Ramghur,—F, Burdwan,—G, Cherra Ponji,—H, Assam

26 There is no fact better established, than that the quality of Coal in India depends on the degree of disturbance to which the adjoining strata, with which it is associated have been exposed. This is exactly what we should expect, from the circumstances of the best beds of Coal being the lowest in the series, and as in all hills and mountains the lower rocks are raised to the higher altitudes, so the lower beds of Coal are those which are projected upwards to the surface * Hence it is due to the greater disturbance of the strata generally beyond the Ganges, that we find the Coal of our Eastern Districts superior to that of the Districts on the Western side of Bengal The main, or lower beds are in the Eastern Districts, upheaved (as in the case of Cherra and Assam Coals) to the surface, where they are found as *Mountain Coal.* In the Burdwan, Rajmehal, and other low Western Coal Districts, the main beds of good Coal may be supposed to lie at a greater depth below the surface than has yet been reached in Coal Mines of this country But in the central table lands and hills Districts to the westward, such as Hazareebaugh, Sohagepore and Nerbudda, where the degree of local disturbance of adjoining strata, corresponds with the Eastern Districts of Sylhet and Assam, the Main Coal is brought to the surface Hence it is, that the Hazareebaugh, and Nerbudda Coals, correspond with those of Assam and Cherra Ponji in point of quality, and are of the most superior description

27 It may be superfluous to notice in this place the intermediate plains between the Eastern and Western Coal Districts of Bengal, further than relates merely to the navigability of Rivers.

The gradual rise of the country westward of Calcutta, renders the navigation of the Rivers in that direction, as they approach the Burdwan District difficult, and of short duration, during the height of the rains. On the eastern side of Calcutta on the contrary, there is a gradual depression, extending perhaps in diminished proportion to that portion of the Sunderbunds, marked 'Morass' on Arrowsmith's Map, a little to the west of Culnah This admits of the general influx of tides throughout the Sunderbunds, which, together with the great Rivers of the eastern parts of Bengal, affords an uninterrupted facility for inland navigation at any season, and consequent ready means for the delivery of Coal from that quarter, to all parts of India.

* Mr Murchison observes that Limestone is more prevalent in the lower beds of the Coal formation in Wales, than in the upper, or newer beds. All our best Coals in Assam and the Khasyah Hills are likewise associated with Limestone While on the other hand no Limestone has yet been found associated with, or in the vicinity of Burdwan, or [illegible] Coals.

Temporary difficulties might in the first instance be felt in obtaining boats at Sylhet on any sudden emergency beyond a certain extent of tonnage, but these would diminish as the demand for tonnage in the District became steady, and the carriage of Coal offered a certain and profitable employment for boats.

28. The following Tabular Statement affords the result of our information as to nature and extent of the indications of Coal throughout India. It will be *seen from it, that the position of 67 beds is* already ascertained, affording an aggregate thickness of 466 feet of Coal.

29. A comparison of this Table with the list of sites in which Coal was supposed to exist on the Continent of India, as enumerated p. 7, Reports of the Committee, 1838, will shew to what extent our information on this subject has been extended since the publication of our first Report.

There is still however unlimited room for further improvement, for it is the nature of the enquiry to expand in magnitude and practical importance in proportion as we approach, and enter into it.

ABSTRACT OF COAL KNOWN IN INDIA 1st May 1845.

Province.	District.	Field.	Locality.	Bed.
Tenasserim Provinces,	Mergue,	Little Tenasserim,	Thian Khan R.,	a, 6 feet. b, 6 feet.
		Great Tenasserim,	a, 20 miles above Tenasserim Town,	a, 6 feet.
			b, Above the falls,	Size not stated.
		Lenhea River,	40 miles from the Coast,	Size not stated.
	Moulmein,	Tavoy, River,	Not stated,	Not traced.
Cuttack (Orissa,)	Gopalpershad,	Talcherguih,	Balajora Nulla, ½ mile from the Fort,	1 foot 6 inches.
		Hingoke,	Singra Nulla,	15 feet.
Bengal,	Damooda,	Singharun R.,	A mile from the junction of the Damooda,	7 feet.
		Barracara,	Burmury Village,	8 or 9 feet.
		Ranee Gunge,	Seven miles above Singharun Nulla,	9 feet.
			Five miles above Ranee Gunge,	7 feet.
		China Coory,	Five miles below the confluence of the Barracara River,	7 feet.
	Adji River,	Churalya,	Quarter of a mile from the south bank of the Adji,	6 feet.
		Moheednuggur,	*North bank of Adji, ¼ of a mile from the River,*	13½ feet.
		Mammudpore,	Two coss south of Seedpore Ghat,	Size not stated.
	Rajmehal,	Bansli River,	Patchwary Pass,	In Sandstone.
		Braminy Nullah,	Doobradgepore Village,	Numerous beds, not described.
		Hurra,	At Teer Mohun,	Not stated.
		Mootee Jurna,	Near the Waterfall,	Not traced.
	Ramgurh,	Bullea,	In the Suncharie, a Tributary of the Haharoo R.,	3 feet.
		Augballa,	On the right side of the Benares New Road near the 187 miles stone,	Not stated.
Behar,	Upper Palamow,	Village of Palamow,	Coyle R. 30 miles from the conflux of the Sone,	3 feet 9 inches.
	Middle Palamow,	Singra Village,	a, Junction of the Amanath and Coyle R.	a, 13 inches. b, 4 feet 7 inches.
			b, above Mirall Village,	6 feet.
		Gorassan Nulla,	Five miles beyond the Village of Chapari,	a, 13 inches. b, 3 feet 9 inches.
	Lower Palamow,	Rajhara,	Sadabah River,	a, 9 inches. b, 6 feet.

Province	District	Field	Locality	Bed
Lower Assam,	Now Gong	Jomoona P.,	North bank a [illegible] above D [illegible]	[illegible]
Sylhet,	[illegible]	[illegible]	[illegible] Mu[illegible]; a on th[illegible] l ft of th[illegible] road	[illegible] 4½ feet.
		e Cherra,		
			[illegible] the bed of a small [illegible] and [illegible] whl [illegible] flows,	Conjectural.
Arracan,	B[illegible] Islands,	[illegible]ugne Keong		a, 3 feet interr[illegible]
		[illegible] Keong		
	[illegible] Island	a Kyuk Phyu,		
		b Hong Valley	a, South [illegible]; b, [illegible]; c, North [illegible]	
		c Keong Dee[illegible]	[illegible]	[illegible]
	Sandway	a K[illegible]	[illegible]	[illegible]
		b Sandway [illegible]	[illegible]	[illegible]
		c C[illegible]	[illegible]	[illegible]
	M[illegible] or [illegible] Island,		[illegible]	[illegible]
	Chaduba Island,		[illegible]	[illegible]

Province.	District.	Field.	Locality.	Bed.
Central Districts,	Ruttenpore,	Hutsoo R.,	Near the Fort of Koorba,	200 yards thick.
	Surgooja,	Manpore,	16 miles south of Chergurh,	3 feet.
		Raher River,	7 miles east of Burra,	Many yards.
	Singrowlie,	Kotah,	Mouzah,	a, 6 inches. b, 1 foot 2 inches.
		Sukhuwan,	Sewallah Mookhe R.	1 foot.
	Sohagepore,	Keyverji R.	Near Seetamadhi,	Not described.
		Johilla R.,	Near Palee,	Not described.
Nerbudda Valley,	Sukur River,	Gurrawara,	a, Benar on the Seeta Rewah River,	a, 20 feet. b, 40 feet. c, 25½ feet.
			b, At the junction of the Hard with the Sukur Rivers,	a, 1 foot. b, 2 feet. c, 4 feet.
	Baitool,	Shawpore,	a, Mardanpore,	6 feet.
			b, Boragurh,	1 foot 9. 1 foot.
		Bhoorna River,	Eight miles south of Bhoorda,	Several beds from 9 inches to 2 feet.
		Nerbudda River,	a, Lemata Ghat,	12 feet.
			b, 400 yards below Lemata Ghat,	6 feet.
		Jubbulpore,	At a depth of 70 feet,	Undescribed.
Guzerat,	Cutch,	Near Bhooj,	a, In the bed of the Trumboo R.,	Several thin seams.
			b, Doojapore,	20 inches.
Upper Assam,	Dhunsiri,	....	Number River on the west bank of the Dhunsiri,	Not traced.
			On a line between Deora and Chambakotee,	Not described.
	Dikoo R.,	Namsang,	Namsang Purbut,	6 feet. 6 feet.
	Suffry River,	Upper Suffry,	a, Tyroo Ghat,	Not described.
			b, West Tyroo,	Not described.
		Lower Suffry,	Bed of Suffry River,	a, 18 feet. b, 37 feet. c, 36 feet.
	Disung R.,	Boorhath,	a, rising ground near the bed of the River about a mile from the Village,	8 feet.
			b, ¼ of a mile from the River on an elevation of 50 or 60 feet,	6 feet.
	Boree Dihing R.,	Jeypore,	a, Geerphong,	a, 9 feet. b, 2 feet. c, 2 feet.
			b, One mile south of Geerphong,	Several beds, size not stated.
		Namroop,	c, Three miles or four from old Beesa,	20 feet.

ASSAM.

32 The Coal Districts of Assam though more or less continuous, particularly along the southern side of the valley for 350 miles, may be conveniently divided into Upper and Lower, corresponding with the division of the province

33 Bishenath, situated 170 miles from Bengal, being taken as the limit between Upper and Lower Assam, we have indications of six coal fields above, and three below

34 Major Jenkins in enclosing to Mr Maddock the latest discoveries of coal in Assam, 26th February and 14th March 1842, urges the expediency of appointing at once, a well-qualified person to examine all the coal beds known to exist in that province.

35 In reply, Major Jenkins was informed that the Governor General proposed to avail himself of the first opportunity of appointing an Officer of experience and the necessary acquirements, to conduct a survey of the coal deposits near the banks of the navigable rivers in Assam, where the best coal is to be found in

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NOTES

Extract of a letter from Major F Jenkins to Government, 26th February, 1842

That His Lordship may judge of the expediency of appointing at once a well qualified person to examine all the beds of coal known in Assam, I will briefly mention the beds yet discovered or supposed to exist

Namroop and Namsang River falling into the Booree Dehing above Jaipoor, little is known to me of the beds in either stream, but I think the quality of the coal is nearly the same, and Major Forbes reported on some, sent down by Lieut Bigge *from the Namroop River, that it was the best for certain purposes of any discovered in India*

At Jaipoor there are three beds, two directly on the gorge of the hills through which the river flows One of these the Assam Company are working and the stratum as far as exposed when I visited it was six feet thick of very fair coal, and containing apparently much less sulphur than in the first small stratum overlying that now working

Half way to Borhaut from Jaipoor is the bed worked by Captain Hannay and Mr Landers above adverted to—I imagine this coal is similar to that of Jaipoor and Borhaut

At Borhaut, directly in the bed of the Disung on both sides, is a deep stratum of coal that has not yet been worked, but the locality seems very favorable

In the Suffery, is the coal worked by Mr Bruce under the late Mr Scott's directions and it was said to be very good. In the Disang is the bed now working by Mr Landers

In the Dhunsiri coal has been traced in several places, but we know nothing of the beds

In the Jumoona there is a coal bed connected with a limestone perfectly identical with the limestone of Cherra, and there is therefore fair grounds for supposing the coal may be of the same quality

The last bed known on the south bank, is that lately discovered by Mr James Bedford on the Cachar Estate under the Garrow hills, of which the coal as far as yet opened appears inferior and earthy, but as the situation is extremely favorable it may be worth while to go on with the operations here to some extent, in the hope of coming upon a richer stratum below —This coal is besides connected with beds of iron ore and pottery clays that seem likely to be of much value

On the north bank several traces of coal have been met with from time to time, but from our recent acquaintance of the Dooars it now seems certain that coal will be found under the northern hills in the same manner as we have found it abound under the southern hills for I have lately had samples of coal from the Galada river, falling into the Brahmapootra at [illegible], which were sent me by Mr Bedford and small samples from Mr C K Hudson and Captain Mathie, of coal found in the Mooas and Bijnee Dooar, and lastly Lieut Scott showed me at Tezpore both good coal and limestone from Koreeaparah Dooar of which he would have made a personal examination but he was driven in by a slight attack of fever

situations affording the greatest facilities for its removal by water to the Presidency. In forwarding this correspondence to the Committee, its opinion was invited.

36. A survey of the coal beds in Lower Assam and Sylhet, was accordingly recommended with the above view, by the Committee.

LOWER ASSAM.

In this part of the province, indications of coal are less decided than in the Upper Assam, but being nearer to Bengal, they are on that account more important.

37. *Durrumpore.* Beds of coal are found in the valley of Durrumpore at the fall of the Jumoona, a confluent of the Kopili River, about 90 miles from Gowahatti, 60 miles of which is an open navigation for the greater part of the year, the remainder is navigable in the rains to the coal beds.

38. A bed of coal, 2½ feet in thickness, is intersected by a little Nullah half a mile above the falls of the Jumoona, and at a distance of 80 or 100 yards from that stream.

39. A second bed occurs in this locality, the particulars of which are not yet known, but a sample of the coal transmitted to the Committee in April 1844, proved on analysis to be one of the purest and finest coals hitherto met with any where: also at a distance of 8 miles above the falls, a small bed of 2½ feet in thickness, has recently been found in a tributary of the Jumoona called Dephoo Nuddee, by Messrs. Wood and J. W. Masters. The quality of the sample furnished from this last bed is not however good.

40. *Kopili River.* In the bed of Kopili River, 24 miles above the confluence of the Jumoona, near a place called Serga, at a distance of ten or twenty miles to the southwest of the preceding coal, drifted specimens have been found in the sands, thereby indicating the existence of beds of coal more or less extensive towards the head of this stream.

Extract of a letter from the Government to Major Jenkins, 14th March, 1842.

I have the honor to acknowledge the receipt of your despatch dated the 26th ultimo, No. 29, submitting your opinion upon Lieut. Col. Garstin's proposal for expending a sum of 1,000 Rupees in obtaining specimens of coal in Assam, and in reply to inform you that the Governor General in Council proposes to avail himself of the first opportunity of appointing an Officer of experience and the necessary acquirements to conduct a survey of the coal deposits near the banks of the navigable rivers of Assam, with a view to determining where the best coal is to be found in situations affording the greatest facilities for its removal by water to the Presidency.

Extract of a letter from Major Jenkins to the Committee, 1st December, 1837.

I have the honor to forward a copy of a letter No. 26 of the 25th instant, from my Assistant Lieut. Vetch in charge of the urrung division, communicating the discovery of traces of coal in three of the rivers flowing from the Bootan range through that vision into the Burrampooter.

Lieut. Vetch has not yet been able to visit the places in which the coal has been found, but he proposes taking the earliest opportunity of doing so, and I trust his further researches will lead to the discovery of the coal in situ.

These discoveries of coal on the north bank of the Burrampooter, and over a tract of country 50 miles in length, appear to me to add greatly to the importance of the previous discoveries of coal on the south bank of the river, for I conceive it may be presumed that we have by no means yet obtained a knowledge of the full extent of the coal beds in Assam, and that it is not improbable they are co-extensive on both sides of the valley, and will be found very nearly throughout its whole length.

The original Sketch alluded to by Lieut. Vetch, I have the honor to annex hereto, and the specimens will be forwarded by dawk banghy.

41. *Monas River.* (Bonash)—at the *Bynee Dooar* on the north side of the valley, 45 miles from the confluence of the Monas with the Burrampooter at Goalpara, and 260 miles from Bauleah on the Ganges, several thin beds of coal were observed by Mr C K. Hudson, in hills on the left bank of the Monas, at its exit from Bootan, along with limestone The place is in all respects favourable for water carriage The size and circumstances of the beds are not described. But, with the exception of Kurribari, this is the most convenient situation in which coal has been hitherto found in Assam.

42. *Kurribari Hills* Detached specimen of good coal have been found in the beds of the Bonarasee river, a tributary of the Kalo, in the Kurribari hills.

43 Drifted fragments have also been found on the north side of Assam in the sands of Jelluadee, and Dhunsiri, in the Kooreapara, and Booreegoomee Doars, 16 miles from the Burrampooter, also on the Belseeree river near the village of Dyamorah, 14 miles from the Burrampooter, and lastly, on the Booroolee and its tributary the Dikrau river, 17 miles from the Burrampooter, a little above Tezpore.

Abstract of Coal in Lower Assam

Province.	District.	Field	Locality	Beds.
Lower Assam, ...	Nowgong, ...	Jumoona River,......	At the Falls,...........	2¼ feet; 2nd bed not described.
		Kopili River,........	Drifted,...	Not traced
	Monas, ...	Bynee Doar,.	Hills on the left bank at the foot of the Bootan Mountains	Not described.
	Kurribari, ...	Bonara see, R.	Garrow Mehals, ...	Not traced

From Lieut Vetch to Major Jenkins, 25th November, 1837

I beg to send you for presentation to the Government Coal Committee, specimens of coal which I have discovered in the channels of the Ghellundee, Belseeree and Bhooroolee rivers

The expectation entertained in my note to you, from having found the same lignites in the Ghellundee of Kooreapara as in the Bhooroolee of Chardooar, with courses about 50 miles apart, but taking their rise from the same chain of mountains that the seam from which they were washed extended along the frontier, is greatly encreased by the discovery of the same lignite in the Belseeree which is central

I particularly beg to bring to notice the specimen marked A found in the bed of the Belseeree which seems to be good coal and to burn freely The lignite is difficult to ignite, but when once on fire gives out a very powerful heat, and is very enduring

As soon as I can spare time I propose visiting the beds of these, and other intermediate streams flowing into the Burrampooter, as far up their course as it is possible to proceed, with the hope of coming upon the main seam

In the accompanying box, the specimens marked A and *a*, are coal and lignite found in the Belseeree river running through Chardooar and found in greater abundance than in the other rivers That marked B, is from the Ghellundee running through Koreahparrah; the same kind is also found in the Dunseeree, (and I sent you a specimen of it some time ago) C, is from the Bhooroolee and also Dekraee, which falls into the former

I have also put up into the box two rather curious specimens, one of the ash of the coal A, in which there appears to be osseous remains, and the other of lignite C, in which a knot in the wood can be distinctly seen, while a formation of iron ore has filled a crack in the same specimen

I have information which leads me to expect the lignite in the whole of the rivers between Dunseeree west and [illegible] east.

I have the pleasure to annex a rough outline of the rivers in this district, marking the places where the coal was found [illegible] letters to correspond with those on the specimens.

44. In Upper Assam we have six Coal Districts as follows:

I. The Dhunseeree, 50 miles above Bishenath.
II. The Dikhoo, 80 miles above Bishenath.
III. Suffry, 80 miles above Bishenath.
IV. Disung, or Boorhath, 90 miles above Bishenath.
V. Boree Dihung, or Jeypore, 100 miles above Bishenath.
VI. Namroop, or Beesa, 180 miles above Bishenath.

45. In these six fields ten beds of coal have already been observed, and their size respectively ascertained; which altogether amounts to an aggregate thickness of 159 feet. This is probably not a third of the contents of these great Coal Fields.

46. Abundance of clay iron stone occurs with the coal of Assam, and is an important feature in the resources of the province especially demanding attention, particularly as it is the very kind of ore from which the bulk of cast iron is made in England.

Copy of a letter from Captain Jenkins to Captain Henderson, Member of the Coal Committee, 23d March, 1837.

I have much pleasure to receive your letter of the 11th, and as it's a holiday to-day, I will proceed immediately to give you all the information I can respecting the Assam Coal Fields, though I may premise that what I have to say is more to point out [illegible] than to [illegible] of the extent of the beds or any details that I could hope would [illegible] the present state of our information.

The first bed of coal that appears to have been brought to notice was that worked by Mr. Scott with a view to supply the steamer intended to ply on the Burrampooter, [illegible] to by you. In description of its position, I must refer you to Wilcox's map of the Eastern Frontier. The first stream opposite to Rungpore, on the south bank of the Burrampooter, is the river called Dhunseeree [illegible], and beyond it [illegible] two small streams [illegible] from the Naga hills; the name of the most easterly is the Suffry. The bed of coal worked by Mr. Scott is on the banks of the latter [illegible] close under the Naga hills. Mr. S. employed Mr. Bruce (the Tea Plantation Superintendent) to raise the coal, and Mr. B. sent down a few thousand maunds to Mr. Scott, but what became of the coal I don't know, except that a small quantity was lying at the [illegible] at Gowhatti when I first came to Assam. It was considered to be very fair coal. Mr. Bruce's report, or some account of his proceedings will be found I think in the reports on Assam by Pemberton and myself. He found the Suffry navigable with difficulty from the rocks which obstructed the channel of the stream, but he was of opinion that the obstructions were readily removable. Mr. Bruce had to encounter some difficulties also from the want of population, but he had overcome these in great measure and was in the way to provide any supply that might have been required when the experiment was closed. The coal lay in a thick stratum close to the surface, and I think Mr. B. found the bed easy to work. In the immediate vicinity were iron mines worked by the Nagas; from my recollection of the account given of these mines, the iron they yielded was a nodular iron ore imbedded in clay—and from the circumstance of the ore lying on the brink of a small declivity, there was every facility for working it. I speak now from imperfect recollection, but I will request Mr. Bruce to favor me for the Committee with an account more to be depended upon. At the source nearly of the Disung nuddee is the old fort of Boorhath—between which and the fort of Jypore are valuable brine springs, though now made little of; they are worked by the Nagas in a very rude way indeed, some account of which you will also find in an Appendix to Pemberton's and my report. Mr. Bruce's elder brother had taken a farm of these brine springs and was providing himself with the necessary iron boilers when he died and the undertaking was abandoned.

The next bed of coal that was brought to light is situated on both banks of the Jumoona river which falls into the branch of the Burrampooter called the Kullung, and that rejoins the great river 8 or 10 miles above this. The coal is found about half way between "Deezoo" and the "Dissaro rivers," and little more is known of it than that it is abundant and associated with precisely the same limestone as that of Sylhet. This coal is good and similar to that of Cherra Ponjee. Of the extent of this field nothing is exactly known, but having lately had a specimen of very fine coal sent me which was picked up in the bed of the Deyong, just where its incorrectly called "Koppelee" by Wilcox, there are grounds for supposing that between the Deyong and Jumoona there is a very extensive field of coal, and there are some reasons for believing that it is not confined to the doab of these two rivers. The lime being known to extend to the Kopili which fall into the Deyong at the places marked Dyung, but which

47 Thus should the coal of Upper Assam be available at present for no other purpose, it may at once be employed in the reduction of the iron ores which occur with it and where both coal and ore are found together, attended with an easy water carriage to all parts of India the result may without difficulty be made of the highest degree of importance

48 The manufacture of iron if once introduced in Upper Assam, would tend greatly to settle this part of the frontier, and might draw into habits of industry, the restless and uncivilized races who inhabit the districts adjoining who appear from the following instance to be quite capable of improvement by such means and upon whom the occupation afforded by working coal mines in the Khassiah hills as well as in Assam has already produced some good effect.

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ought to be read Dyung Mookh—the Dyong or Dyung there losing its name at its junction with the Kopili although the former is the larger river The further indications which denote the probable extension of this coal field are brine springs under the Naga hills at a place called Sunkur facing the centre of the doab of the Jumoona and Dyong and which brine springs continue to the north down the western branch of the Dunsiri river and are connected with lime and hot springs whilst in the eastern branch of the Dhunsiri (the Dyong or Dheeong) are beds of sulphurous alum slates, or rocks related nearly to the coal strata. At a junction of these two streams of the Dhunsiri at Nagahaut ("Naga pate") a little from considerable distance inland on the right bank of this river there are iron clay ores worked of which some account was lately given by Mr Rae the Missionary The Dhunsiri Jumoona and Dyong are small streams but they are navigable half the year for the boats of the province canoes, and bring down large volumes of water equal to any boats in the rains Of the intermediate country along the hills between the Dhunsiri and the Disung I have no information but it appears to me probable that the same formation intends throughout.

In the late expedition of Major White Lieut. Bigge Mr Griffith and Capt Hannay to the Patkaye hills in the direction of the Namroop river they brought to light an extensive bed of coal and several petroleum and brine springs of the coal I have sent samples to James Prinsep and I believe Lieut Bigge has done the same to Gordon, with a full account of what they discovered I will call upon White and Bigge officially to give further details than I am able to furnish—I think I heard that one of the stratums of coal observed by these gents was 10 feet thick The Booree Dihing is also a navigable river

By turning to Wilcox's account of his journey to Borkhamti in the Asiatic Researches you will find that he met with coal in the Noa Dihing and its affluent the Duphapanee From a consideration of all the circumstances before enumerated I think there is reason for supposing that a very extensive coal field or series of fields associated with other valuable minerals, extends from the Singpho hills east along the Naga hills south all the south side of the valley to the hills of Cachar and I cannot help thinking that the same formation somewhere in the Jynteah country crosses the hills and is connected with the formation of Cherra Ponjee and the lime and coal of Pundua and Laour It is certain that from Culmarri along the Canbari hills and the Garrow and Khassia hills to Gowhattee that on the northern face of these hills none but granite formations will be found but at the western extremity of the Canbari hills, the formation changes to laterite and further on there is alum slate and from some part of that neighbourhood—I once saw in Calcutta specimens of numerous fossil remains, from which circumstance and also from a common report that Mr Scott had coal brought him from some spot in the Canbari hills. I am led to believe that the whole of the south of the Garrow hills from Purdua will be found to be of the same formation and that coal may possibly be found close upon the great bend of the Burrampooter than which a more desirable site for a coal bed could scarcely be imagined for the supply of steamers coming through the Sunderbunds and for the general demands of the eastern part of Bengal •

On the whole I think it highly desirable that we should at least try to know what actually does exist, and I should recommend your Committee to endeavour to prevail on Government to appoint a well-qualified person to survey all the south of the Garrow hills from Chilmari to Cherra Ponjee and from thence to cross through Jynteah to the Cachar hills and fall down the Kopili—and after examining all the country on the banks of the Dyong and Jumoona to proceed to the Dhunsiri and thence upwards under the hills all the way to Sadiya. Much might be done in one season if he is at his starting post early—and I should recommend his being at Cherra by the 1st October at latest he could then immediately and safely proceed to examine all the ground above the ghats as far as Laour or Soonam and by the 1st of November he would be able to descend and examine the lower hills round the Chilman—from thence he should return again to Cherra and keep on the high ground until he falls in with the bed of the Kopili, which in about 92° 30' E. Long he would fall in with running nearly S and N to Dyong Mookh By taking this course he will I think undoubtedly ascertain whether the coal formations cross the hills or not

* See Proceedings 7th March 1842, para. 2d.

49. Major Jenkins in addressing the Committee on the subject of the Dikhoo coal beds observes, 100 maunds are ready to be forwarded to Seebsagur, and remarks, (alluding to the person engaged in this duty,) " he is employing the Tablong Nagas, a rude people, with whom we have had very little intercourse, is doing much good, and hopes to effect a contract with them for the supply of coal to the mouth of the Dikho river.*

No. I. Dhunseeree.

50. Coal has been found in two situations on this river, which joins the Burrampooter 30 miles above Bishenath, but we are not informed of any particulars or circumstances connected with the beds.

51. The first situation at which detached fragments of good quality were found, was in the bed of a small stream called Nambar, which falls into the Dhunseeree from the west, at a distance of about 30 miles from the confluence of that river with the Burrampooter.

52. The second locality in which specimens were found in the vicinity of this river, is stated to be in a line between Dezooa and Chumakotee, where the mineral is said to occur in large quantities.

53. In communicating specimens from these sites to the Committee, Major Jenkins observes that they confirm previous indications of the existence of extensive beds on the banks of the Dhunseeree, which is a large, and more manageable river than either the Dihing, or Disung, on which valuable beds of coal also occur.

Abstract of Coal on the Dhunseeree.

Province.	Field.	Localities.	Beds.	
Upper Assam,......	Dhunseeree, ...	Nambar,.........................	1 not traced.	
		On a line between Dezooa and Chambakote, ...	2 not described.	

I have said nothing of the geology of the north bank of the Burrampooter, for in fact I know nothing of it—and the country is nearly inaccessible from the misrule of the Bhoteahs, and the rudeness of Duphlas and Abors who inhabit the lower northern hills—but there is nothing in the state of the south bank that will prevent a full examination of all the border hills—except that our protegé Poorunduz Sing has a feud with the Nagas, but they would not molest any English Gentlemen, accompanied by a half dozen of our sepoys, and whose pursuits were peaceful.

I think I have given you all the information I recollect, but if any thing else occurs to me I shall not fail to address you gain. I am exceedingly anxious to know what mineral resources we do possess in this province, and as I trust to get assistance rom your Committee in prevailing on Government to send us a competent geologist to report on what we have already got imperfect traces of, I shall not be backward in laying before the Committee all the information in my power to induce them to second my application.

Extract of a letter from Lieut. Brodie, 9th May 1837, to Captain Jenkins.

Pieces of coal of good quality were picked up by myself in the bed of the Nambua, a small stream running into the Dhunseeree from the west : near the place where coal was found in the Nambua, is a rock of limestone which extends across the river.

No. II. Dikhoo

54. This coal is situated on the Dikhoo river, 80 miles above Bishenath and 35 miles from the confluence of the Dikhoo river with the Burrampooter. Two beds of coal have here been observed on the western bank of the river, a little above the rapids.

55. In the Namsong hill, a bed of very superior coal occurs, 6 feet in thickness. It was first opened by the Government, and subsequently worked to some extent by the Assam Company, for the use of their own Steamer, the Commander of which certifies to its being the finest coal he ever used.

56. The second bed occurs in another hill bearing a short distance south of the Namsong. In order to make the thing clear, the relative situation of these hills, and the circumstances of the coal, are exhibited in the annexed figure, as we understand the case to be from imperfect descriptions. The size of these beds is not expressly stated, but they are supposed to be each about six feet.



57. Other beds are stated to exist on the eastern bank of the river, but particulars are not stated.

Abstract of Coal on the Dikhoo.

Province.	District.	Locality.	Beds.
Upper Assam, ...	Dikhoo, ...	Namsang, ...	{ 6 feet { 6 feet.

Extract of a Note from Captain Jenkins, 12th September 1839

I send you a lump of coal from a new site near the Dhunsiri, which I shall be obliged by your giving me an opinion of. It has been found, I understand, in large quantity, and near the banks of the above river, in a line between Dezooa and Chamakote of the Nagas, not far from the tract of Tea lately found to exist in that quarter.

From Captain Rogers, Hon. Secy. to Assam Company, 25th January 1845, to Secretary of the Coal Committee.

The trial made by the Assam Company of the coal mines in Assam was limited to about 1000 maunds. The mine was originally opened by the Government at the foot of the Namsang hills, which abound with coal of the finest quality. It is now probable from the rapid success of our Tea manufacture that a Steamer may soon be employed by us in Assam, when the coal will be found most important.

From Mr. Smith, Commander of the Assam Company's Steamer, to Captain Rogers, Hon. Secretary of the Assam Company, 24th January, 1845.

I have great pleasure in informing you that the coal I received at the Diko river was the best I ever had on board a Steamer, generating steam quicker without clinker, and far superior to any coal in Calcutta, &c.

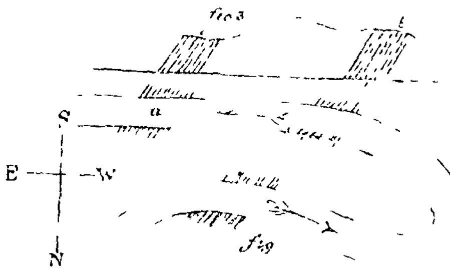
SUFFRY AND DISUNG.

58. The Disung river enters the Burrampooter near the mouth of the Dikhoo, but takes a more oblique course along the foot of the lower range of Naga hills. On one of its branches, the *Suffry*, a tributary falling into the Disung, at a distance of about 30 miles from the confluence of the main river with the Burrampooter, coal has been found at several points, as well as on the main branch of the Disung itself, at Boorhath about 20 miles above the confluence of the Suffry.

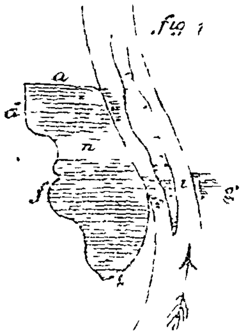
No. III. Suffry.

59. The Suffry river extends in a south westerly direction for a distance of 18 miles towards the Diko coal fields, and in this course intersects several large beds of coal.

60. *Lower Suffry beds*, at a distance probably of 6 or 7 miles from the confluence of the Suffry with the Disung river, several beds of coal, no less than eight, were observed by Mr. Bruce to intersect



the stream and the banks of this river. The annexed figures are reduced from a drawing by Mr. Bruce of one situation in which the bed of the river Fig. 2 is intersected in three places by great seams of coal which are also seen rising up into the bank Fig. 3. The bed *a* is said to be 12 cubits or 18 feet in thickness, and the bed *b* is 25 cubits or 37 feet 6 inches. Mr. Bruce raised a quantity of coal here from these beds at their projecting points—but having been acted upon by the water, he did not think it of such good quality as the following.



61. Half a day's journey further up the river, or probably 3 or 4 miles at the utmost, the navigation is very difficult. Mr. Bruce came to a bed of coal 24 cubits or 36 feet thick, or rather, as would seem from his drawing, two beds separated from each other by a thin band of '*stones*,' shale. Figure 4 is copied from Mr. Bruce's drawing of the out-crop of coal; *d*, *c*, and *f*, *e*, seem to be two distinct beds running in the direction of north east, appearing both on the island *i*, and opposite bank—5000 maunds were raised from this out-crop in 1828, and a boat-load sent to Calcutta for trial; this was pronounced by Captain Forbes to be equal to English coal, and superior to any native coal of this country which he had seen.

Extract of a letter from Mr. A. H. Landers, Special Assistant to the Commissioner.

" The upper strata of coal is six feet high, clay forming the roof. The bed dips at an angle of 40° and buries itself so as to prevent me from tracing it above 100 yards. I am certain it could be worked at a trifling expence."

Limestone, Mr. Landers had reason to believe, occurs under the coal. Another bed of coal was pointed out to Mr. Landers on the very top of Namsang Purbut, bearing south—but size and distance are not mentioned.

62 The first beds Figs. 2, 3 are situated at, or but a short distance above the rapids. From this to the last described bed Fig 4, the stream is obstructed with stones, trees, and ledges of rock, over which the water falls, as Mr Bruce describes, with a loud noise, nevertheless Mr Bruce managed to get boats up to the coal beds, and to bring away several thousand maunds by this means. The river is described as very tortuous, so that the distance for which a road would be required would not be great. Hills containing clay iron are worked for that ore, and Mr Bruce's letter contains drawings of the method used by the natives of the place for obtaining it, which we need not copy as this is merely by sinking wells to a depth of 10 to 40 feet into the summits of the "Iron Hills," and raising the ore up by means of a bamboo (for they have no rope) with a hook at the end, to which a wicker basket is attached From the summit of the iron hills, the ore being in the form of round boulders is rolled down the hill, and collected and worked on the spot, or conveyed in canoes, to the forge The only demand at present for iron in this quarter is the manufacture of *daus,* axes, and spears. The vicinity was, at the period referred to, a dense forest.

63 *Tyroo Ghat* At Tyroo Ghat, a distance probably of seven or eight miles higher up to the Suffry, coal of superior description has also been found to occur, with clay iron stone Specimens of both the coal and the ore have been transmitted to the Committee, for the result of analysis of the former, see No. 62 in

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Letter from Captain Jenkins to Captain H B Henderson, No 167, 4th May 1837

In continuation of my letters of the 6th and 25th ultimo, I have now the honor to forward a copy of a letter of the 20th ultimo, from Mr C A Bruce, regarding the coal beds worked by him under the directions of the late D Scott, Esquire, Governor General's Agent, on the banks of the Suffry, a small stream which falls into the D sung Nuddee

From the observations of Mr Bruce there appear to be several strata of coal in this direction and some considerably lower down the stream than where he commenced operations, and though he considered that further down, to be of inferior quality to what he worked, yet I should think there was little doubt but good coal would have been found below in the deeper strata.

Mr Bruce alludes to having heard of coal being found in the D'kho and also in a river below Dhergong (Dhemsn ?) and to the very numerous position in which Petroleum springs have been discovered under the Naga hills

My preceding letters have given information of the existence of deep beds of coal in the Booree Dihing, and coal was found by Captain Wilcox in two or three places in the Noa Dihing,—coal has likewise been found in Lower Assam in the streams of the Jummona, Dyong and Kopili, so that I conceive we have every grounds for supposing that a very extensive coal formation borders the Naga hills along the whole southern frontier of Assam, as far west as the Jynteah country

I was in great hopes that I should have been able to avail myself of the presence of Mr Assistant Surgeon McClelland when on his late deputation to Assam, to have some of these beds examined by him, but unfortunately the season did not admit of it, and the information I have it therefore in my power to submit is gleaned from the hurried or imperfect inspections and accounts of unscientific observers—but if the Committee are, with myself, convinced that there lies along the southern hill of this valley a series of carboniferous formations unequalled in extent by any yet discovered in India, and as we have every reason to believe containing some beds of coal of excellent quality, the Committee will, I trust, consider the further examination of the tract of country in question a matter of sufficient importance to induce them to recommend the subject to the notice of Government. I do not imagine that the coal is likely to be brought into use for the special purpose which I believe the Committee has principally in view the supply of the Government Steam Vessels and Boats, yet from its superior quality may be made available for other public wants which cannot now be met except from foreign or as distant sources But should the coal fields of Assam be of no present service, for use in Calcutta or the West of India, the full development of our abundant resources in this invaluable mineral may be the occasion of the establishment of local manufactures, or of its conversion to use in the Eastern Provinces, and the production of results highly beneficial to the trade and commerce of Bengal I consider it however quite necessary to advert to the many purposes to which our extensive deposits of coal may be turned to productive account, but I would beg to draw the Committee's attention to the intimate connection of our coal beds with other minerals of the highest value Iron and Salt, and the probable inducements of the known co-existence of these with coal in the same localities to draw European capital and skill to a province, which appears only to want these stimuli to be as valuable to the state as any of the same extent.

the table of analytical results of Indian coal. The size and circumstances of the beds in this locality are not described.

64. *West Tyroo.* Other beds have been observed west of Tyroo Ghat, and approaching towards the Dikhoo; but like the last, particulars as to extent are wanting.

65. Several beds of inferior coal are also said to be intersected by the Suffry in the lower part of its course, not far from its junction with the Disung, regarding which we have no particulars.

Letter from Mr. C. A. Bruce to Captain Jenkins, 20th April, 1837.

I have the pleasure to acquaint you, for the information of the Coal and Iron Committee, that I was deputed by the late D. Scott in 1828 to examine the Suffry river, where the coal had been seen in its bed, and to extract the coal if possible. I found a vein of coal in the bank, on which I commenced work, but as it dipped inland, I was obliged to work that which was on the river —and to be able to do so, I was obliged to drive stakes and to build a bank all round the vein, and to keep people constantly baling the water out whilst digging the coal. On the upper surface right over the coal I found an immense number of trees, and amongst them many walnuts.

With about 100 men I got about 50 maunds of coal per day, but the lower I got and further out into the river, I found the difficulty greater in keeping the pits clear of water, for when we left off work in the evening the pits filled, and we had to throw all the water out with bamboo baskets before we commenced operations again.

I got two natives to blast the coal, thinking by that means to get it out faster, but I suppose there must have been too much water, for we could dig the coal out much faster with our pick axes than they could blast it. The vein was rather a large one, I should say it was 32 cubits in breadth all solid coal—I might have dug 6 to 8 cubits deep into it, and got out from 4 to 5,000 maunds of coal, but am not certain, as I did not keep duplicates of my plans and work which were sent to Mr. Scott and Colonel Cooper. I however have three plans of the pit by me, which I had sent to Mr. Bruce, and copies of which I have the pleasure of enclosing for the Committee—from them they will at once see the nature of the work, size, &c. &c. of the pits. Over at stoney island I met with the same vein, but did not work there, in not being able to keep the water out on account of the stones. On the opposite side of the Suffry from our pit, there was another vein, high upon the bank, but not more than 2 or 3 cubits square of it could be seen. It was set deep in stones about the size of a man's clenched hand.

Half a day's journey lower down I saw another vein running right across the river, and a little lower down I saw two others high up in the bank, I dug a lot of it out, but it did not appear to me to be so good as the one I was working, the outside was rotten coal which had been worked on by the water in the Suffry, but the difficulty is in getting it down from my pit to the nearest navigable river, there lies a small range of hills, on the rout, the pass would have to be cut and widened to permit hackeries to get along. The river again is one of the most dangerous I ever met—I had to go up in the height of the rains in canoes and suppose I was the first person that ever did so—after I had got up two or three rapids the current came down with such force, that I was obliged to send about 20 men on a head with coir rope to lash one end to a bamboo and float it down to the boats—make fast to one, and the people a head would pull her up, thus each one was drawn up in succession. The noise of the water rushing over stones, and past the rocks was so great that we could hardly hear one another when standing together. In going down I lost four boats on account of the short turnings in the river and the rapidity of the current.

Could the coal lower down be worked, there would be less difficulty as it is not so far in the rapids—a few rocks blasted in the cold season would make the passage much safer, and by placing large boats at the end of the rapids, canoes lightly loaded, might employ their cargoes into them and again return the same day for another—but they should be manned with Dooms only.

I met with no less than eight different veins of coal in going down, there may be more.

About half a day's journey from the pit I worked there on small hills that have very good iron in them. I went and visited one, and as I happened to send a drawing of it to Mr. Bruce and will copy and sent it. The iron is smelted close to the hill, worked up into Daws (knives) and sold to the Nagas for cotton, goats, spears, &c. &c. In the Suffry I met with some oil springs. I found it oozing out of the bank into the river, it was rather of a brownish colour. I also met with it not far from the coal pit, this was of a greenish colour, samples I sent to Mr. Scott and Colonel Cooper.

My brother many years ago told me that coal was seen in some river below Dergong, but the people were afraid to work it, as it was so unhealthy. The Committee know of the coal lately discovered in Naum Cheek Panney, it is said to be in the Now Dehing—but I never saw it, and if discovered it would be too far amongst the rapids to be of any use to us. I have been informed that coal was in the Deeko river and strongly suspect that it is.

Abstract of Coal on the Suffry.

Province.	District.	Field.	Locality.	Beds.
Upper Assam, ...	Suffry R., ...	Upper Suffry ..., ..	Tyroo Ghat, ...	Not described.
			West Tyroo, ...	Not described.
		Lower Suffry, ...	Intersected by the stream, ...	a 18 feet. b 37 feet 6 inches. c 36 feet. Several others not specified.
				91 feet.

No IV Boorhath.

66 The coal beds at Boorhath, occur on the Disung river, 20 miles above the confluence of the Suffry. Large boats may ascend in the rains for the coal.

67. The first bed occurs about a mile from the village of Boorhath, at the commencement of rising ground, adjoining the channel of the stream The bed of coal is visible for 100 yards in length, to a thickness of 8 feet above the water and the gravel of the stream.

68. The second bed is about a quarter of a mile distant from the river, at an elevation of about 50 or 60 feet, and is exposed to an extent of 200 yards in length on the bank of a little water course

The quality of both these coals appeared to Major Jenkins to be very superior, an opinion which has been confirmed by analysis of specimens sent to the Committee See No 72, Table of Analytical results of Indian Coals

Abstract of Coal at Boorhath.

Province.	District.	Field.	Locality.	Bed.
Upper Assam, ...	Disung, ...	Boorhath, ...	1 Rising ground near the bed of the river a mile from the river, ...	8 feet.
			2 A quarter of a mile from the river on an elevation of 50 or 60 feet, ...	6 feet.

NOTE.

After adverting in detail to the Boorhath and Jeypoor beds, Captain Jenkins remarks that although no other traces of coal have yet been discovered in the immediate vicinity, it is impossible not to see from what has already been brought to light, the general uniformity of the whole tract, as belonging to the coal formation which comprises all the small ranges of Naga hills for 100 miles in this direction We may hereafter, Captain Jenkins adds, find beds extending far lower down towards the great navigable channel of the Burrampooter, and therefore offering some advantages in regard to transport. But as those advantages would be counterbalanced by greater difficulty of drainage, it seems to him that we are not likely in all Upper Assam to find two points where coal could upon the whole be worked with more advantage than Boorhath and Jypore The two streams which traverse these districts respectively, the Boree Dihing and Disung, are the largest rivers on the south bank and most fitted for navigation.

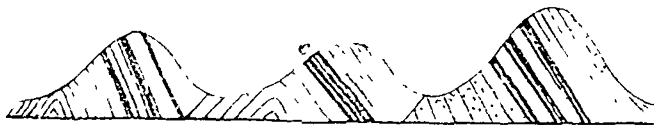
No. V. Jeypore.

69. The coal beds at Jeypore are situated near Geeraphong, a small village, 1½ to 2½ miles from the old Fort of Jeypore, on the east bank of the Boree Dihung River, at a distance of 40 miles from its confluence with the Burrampooter, and 100 miles above Bishenath. The beds appear to be large, numerous, and of various quality, and the coal may be raised and delivered on the bank of the Burrampooter at 1½ anna per maund. We find it difficult to distinguish the several beds for want of a more discriminating account of the size and quality of each, than we possess at present.

70. On the declivity of a low chain hills, two or three miles in length, extended in S. W. direction, a 9 feet bed of coal occurs, alternating with a soft white sandstone containing "masses" of iron ore, and two smaller beds of coal, one above, and the other below the 9 feet bed.

71. A third bed, 11 feet in thickness, is mentioned as intersected by a ravine or water course a little beyond the 9 feet bed.

72. Somewhat better than a mile to the south of the last mentioned bed, there are several others "trending in a direction of 350°, the line of dip being 280°, and dipping at an angle of 45 degrees into the hillock." Thus we might venture perhaps to represent these details as in the annexed figure.



73. In addition to the soft red and white sandstone, the other rocks in the vicinity are described as a greenish coloured soft slaty sandstone, strongly impregnated with petroleum.

Extract of a letter from Captain Hannay to Captain Jenkins, Commissioner of Assam, 15th September, 1838.

I only worked the coal to the extent of 15 yards in length and six feet in depth, and although I found a good deal of slaty substance, much impregnated with pyrites on which pick axes struck fire, still I did not come upon rocks, and to all appearance the vein of coal may extend many yards further down.

The breadth of the vein, including partings, is about 9 feet. Examining the beds of two water courses which pass over the vein of coal, I found several beds of sandstone of the description called by miners white post; it is soft and easily broken, and was intermixed with large masses of iron ore and softened sandstone. There were also two small veins of coal, though several feet higher than the larger vein, evidently appeared to belong to the same bed having the same dip and bearing.

In another place a quarter of a mile distant, where Captain Hannay observed greyish coloured soft shaly sandstone, strongly impregnated with petroleum, of which it affords several springs, the surface is covered with fragments of coal. These lead to a water course which intersects a bed of coal 11 feet in thickness, which Captain Hannay supposed to be a continuation of the one he opened. On proceeding down the water course in a southerly direction, about six furlongs distant, several beds of coal appear dipping into the centre of the hillocks. *See Report Committee*, 1841, p. 4, 5.

74 Regarding the quality of the coal sent to Calcutta in 1838 from the first of these beds marked *a*, fig 2, forty maunds were only equal to thirty-two of Burdwan. From the inferiority of the coal itself as well as from the nature of the shale and sandstone above described, we might venture to infer that the bed from which the sample was derived is superficial coal, and that some of the other beds, *c*, or *h*, which do not appear to have been tried, might have afforded better results. Different beds as may be understood from the foregoing figure may be variously thrown up from below, so that the lower beds (*c*, *h*,) which always constitute the best coal, may by the displacement to which coal beds have been subjected, be as frequently found at the surface in open day as newer beds of which originally occupied a more superficial place.

Abstract of Coal at Jeypore

Province	District	Field	Locality	Bed.
Upper Assam	Boree Dihing R.,	Jeypore, ...	Geerophong,	9 feet. Other smaller beds 11 feet. Numerous other beds, particulars not specified

No VI Namroop

75 Namroop coal is situated near Beesa, 21 miles from the confluence of the Noa Dihing with the Burrampooter, 10 miles above Sudiyah, thus supplying the highest navigable point of the latter river.

76 The only bed as yet observed is situated 3 or 4 miles south of the Beesa, on the bank of the Namroop river, a tributary of the Boree Dihung, about 7 miles above the confluence of these streams, and 2½ miles above the village of Namroop. The bed of coal is 20 feet thick, forming a precipice overhanging the stream.* The quality of the coal is of the most superior description.

Extract of a letter from Capt Jenkins Commissioner of Assam, 19th February* 1839

"Captain Hannay was not aware of the existence of Boor[illegible] coal, the superior facilities of transport offered by which would otherwise have induced him to work it in preference to Jeypore coal. But he could not so well have superintended the labourers," &c.

* This coal was first observed by the late Captain Bigge and Mr Griffith, in April 1837, a fuller description of it will be found in Mr Griffith's journal now under publication. The bank in which the coal occurs is 30 feet high, cons[illegible] chiefly reposing on an absorbent slate clay easily acted upon and softened by the stream. The adjacent country is c[illegible] hills 200 to 300 feet high abounding in springs of Petroleum and Naptha, which prevent the growth of [illegible] vegetation. The Boree Dihing at the confluence of the Namroop, is said to be as large as the Tweed at Kelso.

The Singphos are altogether ignorant of the nature and uses of coal, and Captain Bigge remarked, were greatly surprised to see large lumps of it burst into a brilliant flame as soon as ignited.

Abstract of Coal on the Namroop.

Province.	District.	Field.	Locality.	Bed.
Upper Assam, ...	Beesa, ...	Namroop, ...	2 miles from Beesa,	20 feet.

On the Carriage of Upper Assam Coal to Bengal.

77. To give the Upper Assam coals a fair trial in the N. W. parts of Bengal, advantage should be taken of such facilities as the place affords for building boats from the useless forests on the spot. The late Captain Brodie suggested a plan similar to that followed on the Damooda of building boats, and he considered that if adopted in Assam, it would tend greatly to diminish the expense of carriage.

78. We may here advert to para. 1, Proc. Committee 11th January 1841, by which it appears that 500 maunds boats may be built at 80 to 150 rupees each. We may also refer to another opinion, para. 5, Proc. Committee 6th January 1841, as to the period a boat will last, which with slight repairs is stated to be 10 years. Let us assign 10 rupees per annum for repairs, and 120 rupees for the cost of the boat.

Hence in 10 years the boat would cost	Rupees	220 0 0
For a manjee at 5 rupees per mensem, and 7 boatmen at 4 rupees each per mensem for 10 years,.......................................	„	3960 0 0
Insurance at 3 per cent. on each trip, 2 trips per annum for 10 years, ...	„	250 12 10
Cost of 10,000 maunds of coal at Dikhoo Mouth, on the Burrampooter, at 2 annas per maund, as per result already ascertained on the Boree Dihing, ...	„	625 0 0
Cost of 10,000 maunds on delivery, ...	„	5055 12 10

79. Thus allowing a boat to make two trips a year between the line of depôts on the Ganges and Upper Assam, coal might be delivered for a little more than 8 annas per maund, each boat delivering 1000 maunds annually—200 boats would be requisite to meet the present expenditure.

80. Such boats might be disposed in fleets of 20 or 30, with a clashie to each fleet. A steamer might be employed if necessary to assist the boats and facilitate their progress.

81. The quality of Suffry coal is already known to be most superior, that of Dikhoo is certified by the Commander of the Assam steamer to be the best coal he ever had to do with. Thus although it might cost more, its use would be less expensive than an inferior article.

82. But the beds of Bijnee Doar, and Jumoona in Lower Assam, particularly the former, should first be looked to, as more completely within reach of Bengal.

Abstract of Coal in Upper Assam

Province	District.	Field.	Locality	Beds.
	Dhunseeree P., ..	..	Namber	1 not traced
			On a line between Deoza and Chambakotee ..	2 not described.
	D khoo P.,	Namsang	Namsang Purbut,	6 feet
			T... C...	6 feet
				...ches.
Upper Assam	Disung	Boorl ath	Rising ground near the bed of the river about a mile from the village	8 feet.
			¼ mile from the river on an elevation of 50 or 60 feet	6 feet?
	Poree D hing	Jeypore	Geeruphong	1. 9 feet; 2. 2 feet?; 3. 2 feet?; 4. 11 feet?
			1 m l south of Geeruphong ..	Several beds size not specified
		Namroop,	3 miles from the Noa Dihing	20 feet.
		Total Thickness ..		.. 157 feet [illegible]

83. Kurribari is a low hilly tract situated at the great flexure of the Burrampooter, where it emerges from Assam. The hills apparently 30 to 50 feet high, consist of soft sandstone and beds of clay intersected by ravines. They are thickly wooded and overran with jungle. The face of the country continues pretty much the same for a distance of ten miles into the interior, when the levels begin to rise more abruptly, and at a distance of 16 or 18 miles, elevations of 1500 to 2000 feet occur, forming the lower and outer skirts of the Garrow mountains. The Kalo river rises on the face of the Garrows, and taking a westerly course, enters the Burrampooter opposite to the village of Chilmaree. It is navigable during the rains to Putamaree, a distance of 11 miles from its mouth. Thin beds of a dull earthy coal occur in three distinct localities on the north bank of the river.

84. *Salkora,* 3 miles inland from Putamaree on the north bank, a bed of coal $2\frac{1}{2}$ feet thick occurs alternating with slate clay and friable red and white sandstone, covered with boulders and a deposit of earth. The measurements of these beds are not given, but the whole section does not embrace above 20 or 30 feet. The strata here appear to be level. The hills in which the coal is situated are from 70 to 80 feet high.

This is of a dull brown earthy coal, see No. 91 in the Table of Analysis. It burns freely with a bright flame and might answer for steam purposes although the expenditure would be larger than of ordinary coal.

85. *Mirampara.* This is situated 3 miles eastward of the last described. The same alternation of beds takes place here, with the exception of boulders. The beds in this situation dip 15° to the west. The bed of coal is somewhat smaller than the last, and of a more earthy nature.

86. *Champageree.* This locality is intermediate between the former two, and about a mile further from Patamaree, the beds here consist of slate clay, impure earthy coal, boulders, and clay; they dip 25° to the east.

87. These beds appear to belong to one or more small isolated basins of a spurious coal formation, and are not likely to lead to any important result. The coal resembles specimens of the brown coal of Bornholm, and will probably be found to be equivalent to the brown coal formation. Mr. Sweetland submitted proposals to the Committee for working these beds on the part of Government. Doubtful however of their value, the Committee required before hand to be put in possession of more satisfactory samples than they had seen. These Mr. Sweetland undertook to supply on certain conditions which were complied with, but failing in his object the proposal was abandoned and should never be renewed.

Abstract of Gundoopara Brown Coal Formation.

District.	Field.	Locality.	Bed.
Kurribari, ...	Gundoopara, ...	Salkoora, ...	$2\frac{1}{2}$ feet.
		Mirampara, ...	2 feet.
		Champageree, ...	2 feet.

88. This brown coal formation is not to be confounded with the indications of bituminous coal in the same district, afforded by drifted specimens in the bed of the Bonarosee river, see para. 41, Lower Assam.

89 These are five districts or tracts of country on the eastern frontier of Bengal proper, in which beds of coal have been found, together with three tracts in which the indications are so strong as to leave little doubt of its existence These districts are all immediately adjoining Sylhet. Eleven beds of coal have already been discovered in them at various points during the last 30 years. The aggregate thickness of coal that has been thus ascertained in the Sylhet coal districts amounts to 84 feet 11 inches, which is probably not half their contents.

90 With regard to Sylhet coal generally, its quality being superior, it will on that account always have the preference for seagoing steamers But for river navigation it would have the advantage of all other coals for the supply of the Sunderbunds at Kulna, and Commercolly, as well as Bauleah and the lower ports of the ganges.

91 Carriage from Sylhet to the latter station, or to Calcutta, being considered by boatmen as one and the same, the rates at which Cherra coal may be delivered at both places would of course be alike Hence at Bauleah it is obvious this coal would have a decided advantage over Burdwan for the supply of the upper parts of the Ganges

No I Doorgapore

92 The late Commissioner of the N E. Frontier, Mr Scott, was aware of the existence of coal in the Garrow hills. It has been stated perhaps on his authority that there are two beds in the vicinity of a village called Doorgapore, twenty or thirty miles west of Laour on the corresponding declivity of the same range, a specimen of good coal from this quarter was presented to the Committee in 1837, but no information has since been obtained on the subject.

Abstract of Coal in the Garrow Hills at Doorgapore

District.	Field	Localities.	Beds.
Sylhet, ...	Doorgapore, . .	Garrow Hills, ...	Two, conjectural.

No II Laour

93 Our information of the existence of coal in Sylhet goes as far back as 1813 Enquiries at the period were chiefly directed to the hills in the neighbourhood of Laur, from the number of drifted pieces of coal found in the streams.

NOTES.

Extract of a letter from D Scott, Esquire, to G Swinton Esquire, Chief Secretary to Government of [illegible] 14th February 1828

"In continuation of the subject of my letter to your address of date 1st instant, I beg to acquaint you for the information of the Right Hon'ble the Governor General in Council, that I understand that there are beds of coal in an [illegible] miles above Doorgapore on the Somasree river at the Garrow village of Seerock and Rewak, [illegible] probable that coals for the use of the steam vessel might be supplied much cheaper on the lower part of the [illegible] if sent from Assam."

In the Committee's letter to Lord Auckland under date 18th October 1837, it was stated that [illegible] Cracroft had then persons searching for this coal, but the enquiry came to nothing See Reports Committee [illegible]

94. *Patli River.* Rolled pieces of coal derived, Mr. Jones supposed, from several sources, are plentifully found in this river. Some of the tributaries entering into it from the mountains bring down abundant fragments, which from their appearance led Mr. Jones to conclude that some came from more distant, and others from sources near to the plains.

95. *Susung.* A little beyond Seripore or Cheripore, and near Susung, is a small rivulet in which there is a 9 inch bed of coal.

96. *Second Range of Mountains at Laur.* On the top of this the natives who accompained Messrs. Jones and Stark in 1816 pointed out a bed of coal of good quality 2 feet thick.

Abstract of Coal in the Hills at Laour.

District.	Field.	Locality.	Bed.
Sylhet, ...	Laour, ...	1 Patlie River, ...	Not traced.
		2 Near Susung, ...	9 inches.
		3 On the top of the second range of mountains, ...	2 feet.

No. III. Disung River.

97. In the Disung river and its tributaries Mr. Jones found fragments of common coal but in less quantity than in the rivers at Laour, so much so, that 15 persons were seven days in collecting one maund without finding the source from whence any of the fragments were introduced.

98. Nevertheless the fragments were there, an unquestionable proof of the existence of coal. It would be erroneous to draw any conclusion from the abundance or scarcity of the fragments as to the probable extent of the beds, since large beds might exist apart from rivers or tributary streams into which fragments could not find their way. Such is the case at Cherra Ponji, where no fragments of coal can find their way by natural causes from the mines into the adjacent rivers which consequently contain no fragments.

Abstract of Coal on the Disung.

District.	Field.	Locality.	Bed.
Sylhet, ...	Disung R., ...	Undescribed,...............	Not traced.

No. IV. Between Panatich and Bunsikora.

This locality is not laid down on any map we have seen, but it is somewhere intermediate between Cherra and Laour.

Two beds of coal are found in this locality.

99 *Barachara* This bed was discovered in 1816 when 250 maunds were transmitted to Calcutta for trial and approved of The quality was found to improve still further the deeper the bed was penetrated which induced Mr Stark the gentleman to whom the discovery was due to expect that the quality would eventually equal that of English coal. The size of this bed is not expressly stated but it was understood to be about 6 feet in thickness and so convenient to water carriage that boats might be loaded at the mine Mr Stark experienced some opposition from parties in Sylhet in regard to working this coal, which together with the success of Mr Jones in Burdwan caused it to be abandoned soon after its discovery

100 Messrs. Inglis and Co of Chattak, it is said afterwards expended some four or five thousand rupees on this coal, which they were obliged to abandon in consequence of its being impregnated with sulphur This peculiarity does not seem to have been adverted in the result of the original trials made in Calcutta by the public authorities to whom samples were submitted nor in the trials made of it by Mr Jones a good authority Admitting it to be the fact, all coal being more or less subject to this impurity, it is not a sufficient cause for abandoning a bed some parts of which may be quite free from such objection. In the present instance the objection rests on no definite authority

101 *Cherra Gor* This bed, which is 7 feet 6 inches thick was discovered in 1814 by Mr Stark and examined two years after by Mr Jones by whom it was abandoned in favour of the Barachara bed, para. 99 which was more convenient to water carriage

102 The foregoing beds and indications of coal 93 to 101 have been neglected since 1816, when inquiries were given up in the Sylhet districts from the difficulties with which they were then beset the hilly and mountainous tracts containing coal being in the hands of unconquered tribes and the demand for coal being at the time comparatively small, circumstances are now completely altered, and a proper examination of these districts would seem to be imperatively required.

Abstract of Coal between Panatic and Bunskora

District	Hill	Locality	Bed
Sylhet	Between Panatic and Bunskora	Cherragor, Barachara	7 feet 6 inches. 6 feet.

Assam, Cachar and Burrampooter

103 A letter from Captain Guthrie of the Engineers, was entered on the proceedings of the Committee 2nd of April 1842 from which it appeared that a specimen of coal had been found in a small water course on the side of a hill about 100 feet above the plain of Cachar and half a mile distant from the Arang river a branch of the Soorma, navigable for 600 maunds boats for four months in the year, and for Dinghies for six months.

104 The following is the result of analysis of the specimens in question

Specific gr	1 3
Inflammable matter	61 8
Carbon	32 2
Ash, ...	2 0
	100

It is needless to remark on the interest of such a decided *indication of* the existence of coal in so favourable a place for water carriage, or upon the urgency and importance of this and other similar indications of coal in these districts being properly enquired into.

Abstract of Coal in Cachar and Bikrampore.

District.	Field.	Locality.	Bed.
Sylhet,....................	Bikrampore, ...	A small water course on the side of a hill, $\frac{1}{2}$ a mile distant from the Arang river, ...	Not traced.

No. VI. Tipperah Hills.

105. About two miles from the mouth of a small river which descends from the lower Tipperah hills, petroleum issues from sandstone rocks near the bed of the stream. Mr. Jones sunk to the depth of four feet into the rock when he found it become slaty, thus indicating as he said the presence of coal. Others, he observed, can prosecute the search, the place is well known by an adjoining cluster of small sandstone hills, the most remarkable of which is called Arpeen and has a celebrated Mussulman Durga on the top.

Abstract of Coal in the Tipperah Hills.

District.	Field.	Locality.	Bed.
Tipperah Hills, ...	Arpeen,............. ...	Near the bed of a small stream a sandstone rock from which petroleum issues, ...	Not traced.

No. VII. Chaila Ponji.

106 This coal district is situated in the Khasyah hills, about 12 miles to the west of Cherra Ponji. It is not perhaps distinct from Cherra Ponji, but it belongs to a different native chief.

It is distinguished by three beds of coal which have only been made known since the attempts to work the herra mines were entered upon in 1839. They were all brought to notice by the natives employed in the Cherra mines, with a view to shorten the distance to which that coal has to be carried.

107. *Byrung Bed.* This bed is about two miles from water carriage. It would appear to extend a distance of two or three miles along the foot of the hills, varying in size from one foot to three, and not affording more on an average than one foot of good coal. There are however discrepancies in our information regarding the value of this bed, which time and circumstances can alone remove.

Chaila Bed. This is said to be near the Byrung bed. It varies in thickness from one foot to three, but it is said to yield an inferior coal.

108 *Mustuk Bed.* This is situated higher on the acclivity of the mountain than either of the two previous beds. It occurs near the village of Mustuk, at an elevation of 1500 or 2000 feet. Regarding the size and extent of the bed, there are discrepancies of opinion evincing some doubt; but the quality of the coal is unexceptionable.

Abstract of Coal at Chaila

District.	Field.	Locality.	Bed.
Khasyah Hills, ...	Chaila, ...	Byrung Ponji, ...	1 to 3 feet.
		Chaila, ...	1 to 3 feet.
		Mustuk, ...	4½ feet.

No VIII Cherra Ponji.

109 Cherra Ponji is situated on the brow of a table land composed of horizontal beds of sandstone, raised abruptly to a height of three or four thousand feet from the plains of Sylhet. This table land is capped by small groups of hills rising abruptly from it to an additional height of two or three hundred feet, affording limestone caverns and bold picturesque scenery.

The precipices of which coal forms a considerable part, are 30 or 40 feet high, facing the station of Cherra, from which they are not above a mile distant, they consist of coal, limestone, and shale

110 The annexed Fig 6 is intended to afford an idea of the general situation of these coal beds. Above the coal there are usually a few beds of soft sandstone, loose sharp sand, and clay These are succeeded by thin beds of shale, the coal varies in thickness from 2 feet 8 inches to 28 feet. The coal rests on beds of blackish shale, passing into thin beds of sandstone, followed by a few thin beds of a dull dark coloured gritty limestone, beneath which, a compact dark bluish or blackish grey limestone containing shells occurs.



These rocks consisting evidently of the lower beds of the coal formation, repose on horizontal strata of sandstone already alluded to as forming the table land.
The coal is exposed in three particular situations at Cherra.

111. First, on the left of the road entering Cantonments, the edge of a bed 28 feet in thickness forms a considerable portion of a precipice (at 1 in the annexed Sketch.) This is the nearest bed to the plains, and the one chiefly worked to supply the coal sent down to the Presidency It has recently been found by driving galleries into the hill that the coal becomes thinner, and appears to wedge itself out the further it is pursued underground, so that what appears to be a 28 feet bed at its exposure in the precipice, thins down it is said to 7 or 8 feet.

112 About a mile from the last mentioned, another bed of coal presents itself, 2 feet 8 inches in thickness, at No. 2, this is also in a precipice facing Cantonments. This bed has not, we believe, been worked.
113 The third bed (3 in the annexed Sketch) is situated probably about ½ mile distant from No 2, forming an exposure of coal about 17 feet thick on the opposite declivity.

114. These three exposures of coal were known at Cherra since 1833. Whether any subsequent discoveries have been made we do not know; nor do we know whether these exposures all belongs to one and the same bed making its appearance in different situations, or to several beds. To determine this point would require more geological nicety than has yet been applied to such objects in India.

115. *Serrareem Bed.* This coal which also belongs to the Cherra Ponji Field, is situated several miles further in the interior of the hills, at about the same elevation. It consists of a large bed of superior coal, 12 or 15 feet in thickness, but quite inaccessible at present as regards the plains. Its application to purposes of local improvement in the manufacture of iron will be considered in the proper place.

Six or eight native forges burning charcoal are now carried on in the village of Serrareem, which stands on this bed of coal, and there are probably 200 forges altogether in the vicinity similarly circumstanced, the manufacture of iron being the characteristic employment of the people.

Abstract of Coal at the Cherra.

District.	Field.	Locality.	Bed.
Khasyah Hills, ...	Cherra, ...	1 On the left of the road entering Cantonments, from Mosmye, ...	28 feet.
		2 Facing Cantonments,..................	2 feet 8 inches.
		3 Opposite declivity from the last, ...	17 feet.
		Serrareem, ...	12 to 15 feet.

General Abstract of Coal in the Sylhet Districts.

Province.	District.	Field.	Locality.	Beds.	Average size of each bed. Feet.	In.
Sylhet,.........	Garrow Hills, ...	Doorgapore, ...	Undescribed, ...	Two beds conjectural.		
	Khasyah Hills,	Laour, ...	1 Patli River, ...	Not traced.		
			2 Near Jusung, ...	9 inches, ...	0	9
			3 Top of second range of Hills, ...	2 feet, ...	2	0
		Disung R., ...	Undescribed, ...	Not traced.		
		Between Panatick and Bunsikora,...	Charagow,........................	7 feet 6 inches, ...	7	6
			Barachara, ...	6 feet?	6	0
		Cheila, ...	Byrung Ponji, ...	1 foot to 3, ...	1	6
			Cheila, ...	1 to 3 feet, ...	1	6
			Mustuk,............................	4½ feet?	4	6
		Cherra, ...	1 On the left of the road entering Cantonments from Mosmye, ...	28 feet,..................	28	0
			2 Facing Cantonments, ...	2 feet 8 inches, ...	2	8
			3 Opposite to declivity, ...	17 feet, ...	17	0
			Serrareem, ...	12 to 15 feet, ...	13	6
	Tipperah Hills,...	Arpeen, ...	Near the bed of a small stream a sandstone rock from which Petroleum flows, ...	Not traced.		
	Cachar, ...	Bikrampoor, ...	A small water course on the side of a Hill ½ mile distant from the Arang N.,	Not traced.		
Total of ascertained Coal eighty-four feet eleven inches, ...					84	11

ARRACAN.

This province may be divided into three coal districts.

I The northern consisting of indications of coal between the southern point of Ramree and Akyab.
II The central districts comprising the southern parts of Ramree and adjoining Islands.
III Sandoway or southern district.

117 In these districts 11 beds of coal have been examined, affording an aggregate thickness of 15 feet 8 inches, being an average of 1 foot 5 inches for each bed, the largest not exceeding 20 inches. Where these beds are not exposed to the influence of the tides below high water mark on the coasts, they are so much inclined, or in other words placed in such a vertical position as to render it difficult to work them In other respects some of these beds afford superior coal But the best coal yet derived from Arracan has been found in detached masses, imbedded in sand and clay at Keang Dyeng on the western coast of Ramree, and on the Island of Muggie, as well as a small range of hills at Sandoway, thus unequivocally proving the existence in these vicinities of large beds of coal in this province

In the northern as well as southern divisions of the province, the rocks associated with coal are sandstones and shales.

In the central division, limestone of dark gritty character are described as accompanying these rocks.

I Northern District of Arrakan Coast.

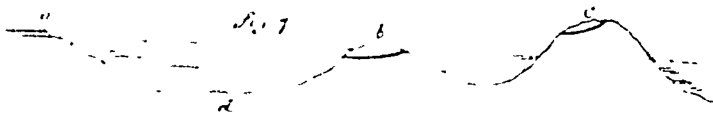
118 *Bolonga Islands.* These are three Islands, each about 20 miles in length and 1 mile broad, placed parallel to each other forming the southern side of the harbour at Akyab. The southern extremities of these Islands seem to be composed of sandstone of the coal formation.

On the western coast of Augno Keong, and about 2 or 3 miles from its southern extremity, coal occurs in three adjoining but distinct situations subject to the tide The strata dipping S W by W In one place the bed of coal appeared to be 5 or 6 feet thick, in another 18 inches, a third still less.

119 At the southern extremity of the middle Island coal occurs, also alternating with sandstone, dipping to the east. The indications afforded by the dip in these instances are interesting as tending to establish the existence of a small sub-marine coal basin at this place

120 *Kyuk Phyu.* At the harbour of Kyuk Phyu coal is found in three situations, namely, in the harbour itself at a big 7 where it is subject to the influence of the tides, and on two small Islands &c in front of the harbour

The submerged ridge (*d*) between the Islands and the main land, is composed of sandstone, and is left dry at low water. The quality of the coal is good, but the situation and extent of the only bed yet observed, is such as to render it scarcely worth working. The annexed figure exhibit the circumstances under which this coal occurs, as we understand them from very imperfect descriptions.



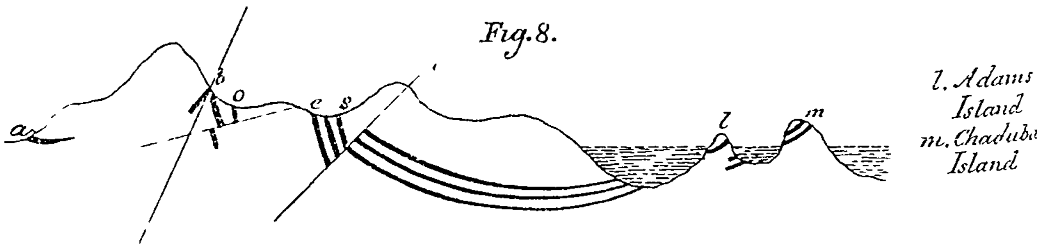
Abstract of Coal at Arracan, Northern.

District.	Field.	Locality.	Beds.
Arracan,..................	Bolonga Island,.........	Western Coast of Augne Keong,......................	5 feet interrupted bed. 1 foot 6 inches interrupted, very small.
		Southern front of Penee Keong,......................	1 foot interrupted.
		Western Coast of Penee Keong,......................	Thin bed.
Ramree, ...	Kyuk Phyu, ...	On two small Islands in front of the harbour, ...	Irregular broken bed.
		On the main land, ...	Irregular broken bed.

II. Central Districts of Arracan Coast.

121. *Hoong.* Coal occurs at Hoong, about six miles south of the town of Ramree, close to a navigable creek falling into the Sandoway Channel. The beds of coal that have been observed here are numerous, but the largest does not exceed 20 inches in thickness, and the strata are inclined to a very high angle, so as to render them inconvenient to work.

The following are the particulars of these beds. Three thin beds of 3 inches, 20 inches, and 15 inches respectively, dipping 75° to the south at the south western extremity of the valley of Hoong. The third or 15 inch bed is said to be cut off by *a fault* from the two first mentioned, and to appear at a distance of 20 yards om them, causing a local irregularity of dip, as represented at *e* in the following sketch.



122 On the northern side of the valley skirting the range of hills in that direction, there are two small beds, at a distance of 2½ to 3½ miles from the first. One of these 20 inches thick occurs at *b*, broken by a *fault* and dipping it is said 80° west, in one side of the *fault*, and 85° E. N. E. in the other, the second bed in this direction *o*, is only 8 inches, three quarters of a mile from which in an easterly direction along the skirts of the hills, *faults* are observed with detached fragments of coal imbedded in sand and clay

123 *Keong Dyeng* On the opposite side of the Adjeekah hills, at a spot marked *n*, Fig 8, coal of very superior quality was found and despatched to Calcutta, but on examination of the place a detached broken mass of coal, and one bed only a few inches thick, were found lying near the surface beneath projecting ledges of sandstone We have no further observation as to the nature and peculiarities of the rocks in this vicinity

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Adjoining Islands, South of Ramree

124 On the Islands immediately adjoining the southern coast of Ramree (*l. m* Fig 8) coal has been found chiefly in detached broken beds, which may probably be connected with the bed at Hoong, as represented in foregoing Fig

Abstract of Coal in the Central District of Arracan

District.	Field.	Locality	Bed.
Ramree Island,	Hoong Valley, .	South Western extremity	3 inches. 20 inches 15 inches.
		South Eastern extremity, .	8 inches.
		North Western side, . .	20 inches. 8 inches.
	Keong Dyeng	Western Coast	Masses of coal detached.
	Chalubn .	On low hills at the south side of the Island	A thin seam
	"		Not traced.
	. .	. .	Detached masses of coal imbedded sand.

NOTES

Report from Lieut Hutchinson dated 1?th May 1842

Arracan from Lat 18 10' to 20° 10' north (beyond which I have not had an opportunity of examining) presents one great cont s fe l of trans t n or secondary rocks, varied only by the frequent occurrence of dykes of igneous origin and points of vol a c act or e ther ext net or in present activity The strata, con i ting of coal bearing sandstones, shales, and fossiliferous l nest nes appear to form the true carboniferous group, but it must remain matter of conjecture of what rock the ba n on wh h these strata were deposited cons ts. The h lest mountains on Ramree Island as well as those as far to the eastward of the pro ices as it has been practicable to examine consist entirely of the upheaved coal measures, nor do the many mud volcanoes in present action, throw any light upon the subject the rejected matter consis ng wholly of blue mud, and the broken up members of the same formation, with the addition only of some small broken masses of quartz rock.

Sandstones const te the most prominent members of the formation they are of all varieties from very fine grained to conglomerates color yellow grey, blue and red, to all degrees of hardness, generally conta ng plates of mica, and from it obta ning a th n foliated structure

Sandstones of a brick red colour are only largely developed in the neighbourhood of Sandway where they appear to be only the equivalents to the yellower rocks of Ramree, and further northward the clay formations and coal seams in connection

126. *Town of Sandoway.* In a small range of hills about a mile from the Town of Sandoway, detached, pieces of coal occur imbedded in sandstone. Three feet below the surface a bed of sand, occurs 9 inches thick, with numerous fragments of coal. Three feet of sandstone follows, and beneath this a similar bed of sandstone with fragments of coal again occurs. This is succeeded with blue shale, which has not been penetrated.

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the excavation from which the coal had been worked, and it was not until a large quantity of rubbish had been removed that a seam, a few inches thick, of broken coal mixed with clay was uncovered The seam is covered by a coarse soft sandstone which slips down in large irregular shaped fragments and has much the appearance of having been in some way shaken throughout, it contains frequent crystals of iron pyrites

The Native authority who superintended the collection of the coal, declares that it was found accumulated on this spot in the same detached lumps, nearly the whole of which he sent into Ramree A spring of water and other circumstances shew plainly the existence of a fault passing through the spot, and I can only account for the appearance of the coal by supposing it to be part of a seam broken up and thrown into its present place by a rupture and movement of the containing rocks—no regular seam has been discovered in the neighbourhood.

" The Bolongas;" minute seams of coal appear upon " Peney Kyoung" and the small island at its southern extremity

Upon " Augrey Kyoung," a seam about 18 inches in thickness, is exposed at the southern extremity of the island, in this seam the shapes of the trees are in a great measure retained; the coal breaks up in slabs across the fibre of the wood, the trees parting from each other so as to shew their original shape and girth, the seam dips towards the sea (S W) at an angle of 55°, and is below high water mark Its enclosing rocks coincide in a great measure with those connected with the coal at Kingtelle Were this even a thicker seam, it would be useless for practical purposes from the peculiarity of its position and dip No other seams have been found on this island

" *Hoong*," the edges of the upheaved strata here assume a general direction at right angles to the usual N N W line, the hill ranges running in nearly an east and west direction. The plaines of Hoong are bounded on the north by one of these ranges extending eastward from the foot of the Adjeekah hills, through a distance of six miles to the sea shore, on the south are interrupted ranges running nearly parallel to, and at a distance of a mile, or mile and a half from the former for two miles, after which they diverge towards the south east. The upper end of the valley is closed by ranges running nearly north and south

Three distinct seams of coal appear at the western or upper extremity, one of which is a dirty seam 3 or 4 inches in thickness. The second is a regular clean coal seam 20 inches in thickness These two lie conformably with 80 feet of coarse sandstone between them They dip 75° southward and can be traced some hundred feet through the hill to the westward. It was from the thicker of these seams that a large specimen was sent to Calcutta under the denomination of " Hoong coal " They are cut off on the east by a fault running N N W, and S S E. on the opposite side of which and 40 feet northward on the line of dislocation, a third seam crops up to the day This seam is 15 inches in thickness, and dips unconformably to the other seams, 60° towards E S E. Its enclosing rocks are also different being thin bedded sandstones and slate clays, one mile further eastward we find a thin seam of foul coal, and a quarter of a mile further a seam 8 inches in thickness, and advancing another half mile we have more foul coal, from which spot following the northern range, we have minute veins and other indications of coal nearly to the sea side Returning to the point first started from, and following the hill on the other side of the valley, we have at a distance of 1½ miles underclay containing minute bits of coal; one mile further there is a seam of coal cut by a fault, and dipping in two different directions, the one being 80° west and the other 85° E. N. E. the seam on one side is 20, and that on the other 8 inches in thickness, the rocks resemble those of the 3rd seam at the upper end of the valley Three quarters of a mile further eastward, a collection of underclay containing detached pieces of coal, occurred. It proved to be six feet in length, 3 in breadth by 2½ in depth, being in the upper part of a fault passing through yellow sandstone, the rest of which appeared to be filled up with a fine mixture of sand and clay The frequent occurrence of thin coal seams on either side of the valley would point out this spot as the field for any farther experiments which might be determined upon. None of the seams at present known are of sufficient thickness to be turned to practical use The great complexity of the dislocations amongst the hills, renders it impracticable to ascertain the relative connection of the seams to each other, or to obtain any thing like a probable section through the measures, by a mere surface survey, although the great dip of all the rocks would appear to offer great facilities for doing so. The plains being covered with a deep soil with but few deep water courses. Sections can only be obtained by ascending the hill torrents, and here the examination is subject to constant interruption—and complicated by a repetition of strata so exactly alike, that I am unable to furnish any thing like a complete section of the measures. I suppose that the coal bearing strata which appear above

TENASSERIM PROVINCES.

128 Four coal fields are indicated in these provinces.

I On the Great Tenasserim river, 67 miles above Tenasserim Town.
II Above the falls of the Great Tenasserim
III On the Thian Khan or great branch of the little Tenasserim river
IV. On the Lenhea river

The first of these are mere indications, the second consist of a six feet bed of crop coal which has already been worked to some extent, but abandoned as of inferior quality

The third or Thian Khan coal field is decidedly the most important, both from extent and situations as well as the superior quality of the coal. It was at first supposed to be situated beyond the boundary range of hills, but such is not the case, so that there is really nothing to prevent this from becoming the most important coal in India, particularly for the supply of Ceylon and the Straits.

Of the fourth Tenasserim coal field, we as yet know nothing more than existence on the banks of the Lenhea river

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NOTES.

Report on the Coal of the Great Tenasserim, by Captain Tremenheere, Executive Engineer, dated 10th June 1841

Locality

This coal field is situated on the Great Tenasserim river about sixty seven miles from the port of Mergui The delta of the river occupies twenty miles of coast, within which space there are many outlets, but the navigable channel discharges itself three miles south of the Town Its course in ascending has a south eastern direction for thirty-eight miles, when it turns suddenly to the northward, it is here joined by the little Tenasserim river from the south, and the ancient capital of the province, the town of Tenasserim is situated at the point of junction The coal is 17 miles due north of Tenasserim but the sinuosities of the river increase the distance to twenty nine miles

The River

2 The banks of the river are in a few places one hundred and one hundred and twenty yards apart, but two hundred yards may be called the average breadth above Tenasserim below this it is in no part less than three hundred

It discharges a large body of water during the south west monsoon, the greatest difference of level at different seasons observed at the coal site is thirty five feet, and though there is a rise of tide at Mergui of 18 feet, ships at anchor there during the freshes are said not to swing to the flood At Tenasserim the daily rise and fall is 6 feet which, sixteen miles higher up, is reduced to 1½ feet, and though the highest springs are felt within eight miles of the coal, the tide cannot be said to assist navigation for more than fifty four miles

3 I passed up the river for the purpose of inspecting the coal mine between the 12th and 16th of April, when the channel is confined to nearly its narrowest limits For the first forty nine miles it is little effected in point of utility by the changes of season, it affords for that distance a broad and deep channel entirely free from rocks or other impediments and is at all times fit for inland navigation of any description Above this the course becomes more tortuous, and the rise of its bed increases by a succession of platforms, the edges of which present, at this season, sloping ridges of gravel across the stream which cannot be avoided.

Obstructions in the River

They are fourteen in number, but the difference of level at each step is not great, and the current not accelerated thereby at any one point to more than 4½ miles per hour The depth of water above and below was usually 3 feet, but on these gravel banks, it varied from 1 foot 10 inches to 1 foot 6 inches and 13 inches. They are from forty to eighty yards in extent, and form with the sand banks some sudden turns in the stream. Its width for the last eighteen miles was very variable, but there was, one point excepted abundance of waterway, and no other obstructions than the banks just described. At the point alluded to the stream was restricted to 70 feet with a current of 3½ knots, the current at other parts being about 2 knots

but on the east bank they attain twice that altitude at a distance of three or four miles from the river The valley consists of coal formation, such as thin beds of shale, containing impressions of plants, alternating with thin beds of course sandstone and coal, partially sub-divided by low hills composed of clay slate and porphyry along the flanks of which an out crop of coal is observed.

The shales from the roof of the coal have numerous vegetable impressions but of small size, and they appear to be allied to existing species. The series of beds above the coal which are seen in the opposite side of the river and will be hereafter described amounting to 500 feet, consist chiefly of soft shales of various colours, sandstone and shale conglomerate composed of the debris of other strata similar to their own They are also intersected in two places by parallel dykes of igneous rock, but none of them seem to have undergone that degree of pressure and solidification which is apparent in coal measure shales of the older periods, nor have there been yet seen any specimen of organic substances amongst them to authorize their being referred thereto

10 In the absence of guides by which these questions are usually decided and with the anomalous character of the adjoining rocks the true nature of the coal must be determined by external characters, by its behaviour in the fire and by its composition

The quality of Coal.

11 It is found in a hard and solid bed consisting of layers of slaty structure parallel to the bed and is easily separated in that direction Between the lamin there are thin plates of arsenical iron pyrites It is brought to the surface in cuboidal pieces which do not however preserve their size under rough treatment. Its cross fracture is conchoidal and it is fibrous dividing into thin plates in the opposite direction, while its flat surfaces present a ringed appearance much resembling the ringing of wood as seen in transverse sections. Its lustre is somewhat glistening when freshly broken on the mine and colour dull black but after exposure to the atmosphere it loses this appearance and assumes a brownish black colour It does not soil the fingers but is deficient in that "glow" or metallic lustre which is eminently characteristic of mineral coal Its specific gravity is 1 2 In the flame of a spirit lamp it exhibits some inflammable gas and gives off a small quantity of brown oily bitumen it does not swell and emits but little smoke It consists chiefly of carbon and leaves when well burnt a very small proportion of residue

100 Grains of this coal gives

Of Volatile matter	Grains	9 80
Soluble matter		·98
, Insoluble matter		1·06
Earthy residue,		1·60
		100·00

In an open fire it refuses to enflame without the action of the bellows, and will not do so without a strong draught. When burnt in the fire its appearance very much resembles that of common charcoal the thin plates before mentioned assuming that divergent shape observable in charred wood The conclusion to which from the foregoing considerations, I have arrived is, that it belongs to that description of coal termed wood coal or lignite

12 Its serviceable qualities are not best determined in the laboratory It burns well in the fires of the Marine Engine at the mine and no difficulty is found there in keeping up the steam The fire bars were placed at small intervals to suit the coal which is liable to break up into small pieces No rate of expenditure had been determined as the Engine was worked much under its full power 20 tons were shipped at Madras in the India Steamer and the report by the Commander Captain Henderson and of the Chief Engineer on board which was published is satisfactory It is stated to require great care and labor "to manage "the fires well but not more than is required with the Burdwan coal that it has a strong heat and could keep good steam with "careful firing" Its consumption when compared to English bituminous coal was estimated as 4 to 3 during a short trial and from 10 to 12 miles per hour I have heard however other statements which are not so favourable I find that a ton weight of the loose coal occupies 16 cubic feet There are at present about 100 tons at Mergui and I would suggest that a careful trial be made of this quantity to ascertain its real effect in the duty of Steam Engines.

13 I proceeded to trace the connection of the bed with the adjoining rocks and to ascertain if possible the position of the coal beds of this locality The ground had been penetrated in four other places besides the mine marked 2 3 4 5 in the plan and in its immediate neighbourhood. No. 2 shaft passed through the 6 feet bed

Shafts practised

from the nature of the coal itself as well as of the beds with which it is associated. It would seem however from all we can learn, as well as from samples of the coal, to belong to the upper portion of the coal formation, and it may be a question as suggested by Captain Tremenheere whether in a space so circumscribed, and cut off by primitive mountains, the lower and better beds of coal are to be expected in this valley

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impressions and coal, and at *d* there is a seam of coal cropping out at the level of the river The intermediate shales are variegated, brown, white, striped blue and black

Thickness of these beds.

16 Section No. 1 represents these beds as they appear at different points above the level of the river along the line of bank A B The measurements taken on the line and the uniform angle of dip gives a total thickness of 500 feet.

17 At the point c there is a change in the rocks, and hard and red clay with rounded fragments of shale passes into the shales, but without any alternation on the angle of dip, and at 200 yards up the stream they cease altogether, the bank being then composed entirely of clay.

18 In proceeding higher up the river with a view to trace these beds and ascertain their true angle of dip, and after passing the hill at E, the northern extremity of the lesser range, there is a reach of the river bearing east and west, or nearly at right angles to its general course, and at the western part of this reach I again found the same series of coal beds well exposed on the bank for half a mile along the line C D as shown in section No 2 They have evidently been the cause of this short and sudden bend of the river The rocks first appear in this reach near the point D where for a short distance as at *b*, *c*, on the other face they are hardened by contact with a dyke of igneous rock which shows itself at C" in the line C D At *p* soft shales with seams of under clay and coal are found, at *d"* a seam of coal crops out at the level of the river, which being at the same level belongs without doubt to the same beds which are indicated on the other side of this tongue of land at *d* The beds upwards from *d"* consist of striped blue and soft grey shales, the whole resting uniformly upon each other and dipping at one angle of 12° up the stream, or to the eastward till we arrived at the point *o"* where there is another igneous dyke and the strata are thrown down thereby to the eastward at an angle of 30°. These were followed as far as the point S" in the Yaibou river to which they continue at the same high angle, but beyond this and for some distance higher up the Yaibou all trace of them is lost.

19 The correspondence of the bed *c" c*, *d" d*, of the dykes *c" c*, *o" o* and faults S" S and the phenomena accompanying them leads at once to the inference that the edges of rock as seen along the lines C, D, A, B, present two views of the same beds, that their angle of greatest dip is 12°, and that they are continuous from one side of this tongue of land to the other In examining the country inland, the dyke *o* was distinctly marked at various points between *o* and *o"* and its direction is shown on the plan

Igneous rock was also found at intervals between *c* and *c"* denoting that though these igneous dykes passed through the coal field and disturbed the continuity of the beds, they remained between the two dykes and across the tract between *o" c" c o*, unbroken, and resting on one another with great regularity, at an angle with the horizon varying from 7, 9 to 12 degrees. The space covered thereby is 1¾ miles in length by 400 yards in average breadth.

The workable bed of Coal.

20 The bed of coal at *d" d* I believe to be of the same thickness and quality as that which has been worked at the mine There is in the bed of the stream near the opening of the mine at I, the fractured edge of a ferruginous rock distinctly marked, which dips immediately below the coal at the same angle with it, and has been forced up at the same period The bearing of this edge is 2½ degrees east of north which is denoted by a black dotted line in the plan. The position of the out crop of coal *d"* which was arrived at by observations independent of the line of bearing alluded to, is as nearly as possible upon this line, and the coal shown at these two points formed I conceive at one period a continuous bed. A quantity of hard specimens were collected at the points *d d"* as soon as the coal was pointed out, but being on a level with and below the water with a high precipitous bank above, the depth of the bed could not be ascertained immediately.

Instructions have been left with Lieut. Hutchinson to penetrate the coal near the two points *d" d*, and report on the thickness of the working bed without delay

Section No. 3 which is taken in a direction from west to east, from the gorge of the lesser range at G to the east bank of the river at *m*, shows the relative positions of the coal which has been worked and the bed *d d"* at the point *m*, where the section strikes the opposite bank It includes the shafts and other excavations the depths of which are shown at their proper level. The space between these and the river is covered by sands, clays and other superficial deposits without any indication of coal.

131. The 6 feet bed though a surface coal, was worked to some extent, but the result was not altogether satisfactory. The means employed are supposed to have been inadequate to afford a fair trial. But as the

Abstract of Coal on the Tenasserim River below the Falls.

District.	Field.	Locality.	Beds.
Great Tenasserim, ...	60 miles above Tenasserim Town, ...	In a small valley, ¼ of a mile from the west bank,	6 feet.

The beds are broken off abruptly along the line A. B. and the dep
river in the absence of any other indication than the disturbed stra
space to the northward of this betwee e G. W. H. and th
to the same chances; but supposing be continuous with
at any intermediate point between this line at a le
asons I am co
Recommends the mine, &c. to be abandoned and work to be continued on the opposite side of the river.
west l ly abandon
the op ısferred to t
by a d plan, and
measures within this space lie in a ourable fo
are protected from all but surfac inclinati
which dips away from them to the e and th
d″ o″ in the plan at such depth as ma nce t
The total depth of these beds ascert is
of coal (one most convenient size for w and
other beds of workable coal. Experime h

they might be found on the west side of the
4, would be subject to much uncertainty. The
coal at *d* ts *d* L would be subject
the riv gh it would not be reached
feet t level of the river.
d th therto prosecuted on the
able m this coal field, that
river its of the space marked
ou mentioned. T
ıt ate angle of
the igneous
of the sp
tion

22.

The extent of workable coal.

considered w
northern extre
the surface ints *d d″*, and to th
reached ng 50 fatho
but pits fo t along
100 feet bel th
igneous dykes o i
contingency I sh
eastward of the lin
her end of the be

Additional Machinery required.

speed, 40 revolutions per min
work to make it available as a
and 10 inch lift without air ves
winches worked by hand. The
necessary and should be supplied
immediate use, together with drawin
smallest outlay which will enable the w

object on lay to the quality of the coal it may be doubted whether any means that could be brought to bear could improve it, otherwise than by the discovery of a better bed.

Present and future expenses. 24 The following is an account of the expenses of the present Establishment and of that which would be required after the requisite additions to the machinery have been made

For One Month

Present Establishment.	Amount.			Number required when Machinery is complete	Amount.		
Superintendent,	200	0	0		200	0	0
Sub Assistant Surgeon,	185	0	0		185	0	0
1 Overseer	50	0	0	..	50	0	0
4 Miners at 30 rupees each	120	0	0		120	0	0
3 Smiths at 30 rupees each	90	0	0	4 Smiths at 30 rupees,	120	0	0
1 Ditto at 40 rupees	40	0	0		40	0	0
1 Carpenter at 45	45	0	0		45	0	0
3 Ditto at 35 ..	105	0	0		105	0	0
4 Ditto at 30	120	0	0	Not required after the machinery is erected			
1 Ditto at 20	20	0	0				
1 Head Cooley at 13	13	0	0	..	13	0	0
6 Coolies about the mine and workshop at 12	72	0	0		72	0	0
4 Coolies cutting trees for the mine at 10	40	0	0		40	0	0
1 " felling timber at 10	10	0	0	..	10	0	0
10 building and repairing at 10	100	0	0		100	0	0
16 carrying rice and other stores from the river side	160	0	0	Not required after a tram road is placed			
Total	1370	0	0	Total,	1100	0	0
Convict Labor				Convict Labor			
21 Convicts about the Jail, Hospital and in charge of tools,				21			
1 Carpenter				1			
8 Sawyers,				8			
32 Colliers,				30			
53 Raising away and heaving coal				15 ..	...		
10 Lower pumps				Not required			
21 Road making				20		..	
2 Oil Mill ..				2			
7 Daily cleaning				7			
9 Cooks,				6	...		
31 Sick and convalescent at 16 per cent				11 at 10 per cent. for lighter work			
195 Convicts at 5 rupees,	975	0	0	121 Convicts at 5 rupees each	605	0	0
Boat hire and other small expenses, ..	150	0	0	..	150	0	0
				Supervisor of Bamboo Forests,	20	0	0
				1 Engineer ...	50	0	0
				4 Coolies on account of machinery at 12 rupees,	48	0	0
Present Monthly Expenses, Total,	2495	0	0	Total, ...	1973	0	0

The fault for which this coal was condemned, and the mine abandoned, was, that it contained pyrites, and was on that account subject to spontaneous combustion, but as already remarked all coal contains more or less of this impurity, which affects only particular parts of the bed and by proper attention may be easily avoided. But independent of this, the coal itself is only of second or third rate quality.

An addition to the salary of the European Overseer who has the responsible charge of tools, materials, &c., of 30 rupees per month is recommended, and I venture to suggest that if the work proceed on the scale proposed the allowances of the Superintendent be placed on the same footing as those of Engineer Officers holding charges of equal importance and responsibility. I consider 2nd Lieutenant Hutchinson qualified in every respect to conduct any operations at the coal field that may be determined upon.

25. It is proposed to raise the coal from two shafts by means of cattle wheels, which can be constructed on the spot from a model which has been left with Lieutenant Hutchinson. There is abundance of good timber at hand (the Peemah) for this purpose.

Price at which coal may be shipped at Mergui.

26. Placing the utmost limit of expenditure, with the means above detailed, provide for all contingencies at 2200 rupees per month, the cost of coal at the pit's mouth, when the machinery is fixed and the mine fairly open, may be thus estimated. If only 10 tons be raised daily from each shaft, 20 tons per day for 25 days = 500 tons per month at a cost of 2200 rupees. The cost of 1 ton will therefore be 4 rupees 6 annas 5 pie, or 2 annas 6 pie per maund. The coal is at present brought down the river on bamboo rafts. The present cost of transport to Mergui by contract amounts to 2 annas 9 pie per maund, being carried on men's shoulders a distance of 1300 yards to the river, but if conveyed on a tram road and lodged upon the raft, for which the new arrangements provide, the cost of carriage to Mergui would be reduced to 1 anna 7 pie per maund, making the total cost of coal brought alongside shipping at that place 4 annas 1 pie per maund.

To be shipped if possible from the raft.

27. While upon the raft the coal is almost wholly immersed in water. Landing it at Mergui should be avoided as much as possible, and it should in all practicable cases be shipped from the rafts.

28. During four months of the year from 15th June to 15th October a steam tug, with tenders lashed alongside, might be usefully employed in conveying coal to Mergui, and would perform nine trips in the month, but owing to the sudden turns and set of the stream in various places before noticed, together with the shallowness of the water and the rapidity of the current at those parts during the rest of the year, I am unable to suggest any better or more economical method of conveying coal down the river during that period than by the bamboo rafts hitherto used.

Supervisor of Bamboo Forests.

29. There is no apprehension of a deficiency of bamboos for their construction for an unlimited period, but to secure an unfailing supply within a moderate distance of the coal field and to prevent waste and destruction by the contractors supplying the rafts, the services of a native supervisor are necessary. The wages of such a person are provided for in the estimate of future expenses.

30. On the 2nd of May I quitted the coal field. The river had then risen 1 cubit, but it fell afterwards to its former level. The water this year was considered unusually low. Some loaded rafts which had been dispatched on the first rise were, after proceeding a few miles, detained at one of the shallows and had not arrived at Mergui on the 20th the day on which I embarked.

II Above the Falls

132 Above the falls of the great Tenasserim, near a small tributary called *Nan their Keung*, a mile and quarter from the main river, three small beds of coal have been observed in sandstone, and about one day's journey lower down the river, thin seams of coal are exposed in sandstone in the banks.

Abstract of Coal on the Tenasserim River above the Falls

District.	Field	Locality.	Beds.
Great Tenasserim, ...	Above the Falls, ...	A small Tributary called Nan their Keung, a mile and quarter from the main river,	3 small beds in sandstone.
		One day's journey lower down the river, ...	Thin seams in sandstone.

III. Thian Khan Coal Field.

133. [illegible]
capable of [illegible]
Khan, one [illegible]
beyond the boundary range of our territory, and thereby cut off from access with the coast, the Committee overlooked its importance in former reports. But these geographical errors have been perfectly removed by Captain McLeod, an officer of long experience and distinguished service on this part of the coast who, in an able article in the Journal of the Asiatic Society, proves this coal district to be within the British Territory, and so far from intercepted by any range of hills whatever, that an open navigation extends to within 20 miles of the coal at all seasons, and that rafts ascend to the coal itself during the rains

134 The first bed appears five days' journey above Tenasserim Town, exposed on the bank of the Thian Khan river, to an extent of 240 feet, 6 feet in thickness, and dipping at an angle of 20°.

Extract of a Report on Coal discovered in the Tenasserim Provinces, by Dr Helfer, 23d May, 1838

Five localities of coal have hitherto been found in the Tenasserim Provinces, all situated in the province of Mergui

1st. On the great Tenasserim, nine days' journey from Tenasserim town, near the creek called Nan their Keungnr one and a quarter miles inland Species friable brown coal intermixed with iron pyrites Three veins occur in different localities. 2nd, eight days' journey from Tenasserim town, along the banks of the river Species of lignite and light slaty brown coal occur in veins, three or four inches thick, &c Vide Journal of the Asiatic Society, 1838, p 701

From the Report of Dr Helfer in the Journal of the Asiatic Society, Vol. VII 1838.

On the coal river, a branch of the Little Tenasserim, five days' journey by water, in a south-east direction [illegible] 120 [illegible] The bed, 6 feet thick, 240 feet long, dips at an angle of 20 degrees in the bank of the river [illegible] distant an immense coal field of either slaty or conchoidal pitch coal occurs, highly [illegible] without pyrites. A [illegible] of fourteen localities where the coal lies bare on clay on both sides of the river occur, running at an angle of 2[illegible] [illegible] river breaking its way through the coal in all places 6 feet or more thick, resting on a stratum of slate

135. Two or three miles above this, a similar bed of coal, or what is equally probable several beds of similar size and quality are observed in fourteen different localities, partially exposed on both sides of the river, dipping at an angle of 25°. These beds seem to occur with grey and black slate clay, the latter is supposed to rest on blue limestone.

This extensive coal field is situated on a high level table land, only diversified by an isolated range of mountains, from which the river passes through the coal fields. The river is above 15 yards broad, nearly dry part of the year, but uniformly navigable for rafts for five months of the year up to the coal field.

The coal itself is of superior quality, being that peculiar species known in England as pitch coal, which is much higher in price than the common coal, and on account of the greater quantity of bitumen which it contains, is used for the generation of gas.

A great advantage of the locality is the total absence of land carriage as the pits are in fact opened by the river. The difficulty of navigation is confined to the last 20 miles, the passage being there obstructed by sunken trees and drift wood.

The last 30 miles being navigable only during five months of the year; it would be necessary to have a depot of coal near this situation, ready to be shipped when the water begins to rise.

A depot should also be formed at Mergui, where vessels could easily approach the shore.

The stratum above the coal is no where more than 25 feet, and consists of bad slaty coal, grey and debris of slate with coarse gravel and alluvium.

Digging.

a, 1. Person digs in one day 20 maunds, in 6 days 120, in a year 6,240. Wanted for 10,000 Tons 43 men, say 45.
One Convict at 4 Rs. per month,.................................... 45 × 4 = 180 × 12 = 2160 Rs.

b, Working 9 hours per day a person transports from the coal pit (15 feet deep) to the water edge 200 yards distant, in ten minutes, a cart load. To transport 10,000 tons therefore 38 men, say 40 are required.
Being Convicts at 4 Rs. per month, ... 40 × 4 = 160 × 12 = 1920 Rs.

Transport, on bamboo rafts.

a, Each bamboo raft, 25 feet long by 6 feet broad (double bottom 2 feet high) holds 1 ton of coal, 10,000 rafts therefore necessary.

b, Two men fill and construct such raft in one day, it is therefore necessary to employ 20,000 men's labour for one day, at 3 annas 1 pice wages per day, ... 6666 Rs.

c, To load the rafts the same number of men is required as (a. b.) according to the above calculation, ... 1920 Rs.

d, The river is navigable for five months of the year, from June and to November exclusive. In this time 66 rafts must be despatched every day.

e, Going slowly the rafts arrive during the monsoon in three days, at the junction of the coal river, with the other forming the little Tenasserim. To this point two men are required to direct each raft, 10,000 rafts each, ... 19998 Rs.

f, Two men three days pay from there to the junction of the great Tenasserim river, going slowly two days distance. At this place the river is so broad that eight rafts fastened two abreast can be directed by two men.
1,250 rafts × 2 days at 5 a. 1 p., ... 1866 Rs.

g, From the village of Tenasserim to Mergui, two days, (with the tide) 16 rafts can be tied together, directed by two men.
625 rafts × 2 m. at 5 Rs. 1 p., ... 933 Rs.

Pay of the labourers going back by a straight road cut across the jungle.
Required 20,000 men's labour (each raft two men) three days,.................................... 20000 Rs.

136 The river is described by the late Dr Helfer (to whom the discovery is due) as breaking its course through coal beds of great extent.

These beds are imperfectly described, but they seem to occur with what Dr Helfer described as grey and black slate clay, the latter being supposed by him to rest on limestone.

137 The various beds appears to be what is called cannel coal, remarkable for consisting of upwards of 50 per cent of bitumen which to use the words of Mr James Prinsep (Journal Asiatic Society, 1838, p. 706) "shews it to be a superior blazing material which is the main point in getting up steam, so much so" he continues "that I understand one of the Company's Steamers is unable to get up steam with the *Burdwan* coal without a large admixture of English cannel coal It also continued Mr Prinsep, makes an admirable coal for gas."

Lieut.-Col. Forbes and the Secretary of the Committee were present during Mr Prinsep's experiments with this coal and were equally impressed with Mr Prinsep himself as to its remarkable superior properties for steam, gas, and coke.

Establishment

1 One Superintendent.
2 One Cashier and Book keeper
Two Depot Overseers
d One Overseer for transport down river
e One Overseer for building rafts.
f Ten Miner Overseers in the coal pits, say Two Thousand Rupees per month
24000 Rupees.
1000 Repair of different buildings, wear of implements and instruments.
2000 Unforeseen expenses.

Abstract

a	Work in the coal pits,	2160 ×
b	Transport to the water edge	1[illegible]0 ×
c	Building rafts	5666 ×
d	Loading rafts,	1990 ×
e	First three days transport	1[illegible]998 ×
f	Next two days transport,	1866 ×
g	Transport from Tenasserim to Mergui,	933
h	Return pay	20000
i	Superintendents,	24000
k	Repairs,	1000
l	Unforeseen expenses,	2000
		82463

N B 1 The employment of Convicts by the Government would effect a saving in some of the above items.

Hence 6000 might be deducted from 82463 = = 76463—100 bamboo rafts, of 2[illegible] feet length fetch in Mergui the price of 1 R 8 As. to 2 Rs. but say 1 Rs. ——— 30 × ——— 10000.

300000 Bamboos.

Sale of Bamboos, 3000 Rs.

Deducted from 76463 = 73463

73463 Rs. = 1175408 Annas divided by 2[illegible]3170 maunds.

Price of one maund 4[illegible] or ½ Anna in Mergui counting free labour at 10 Rs. per month

The following are the results of analysis of four specimens of this coal by Mr. Prinsep, taken indescriminately from as many bags. Journal Asiatic Society, 1838, p. 706.

All four burn with copious rich flame, coke close grained, and of highly metallic lustre.

	No. 1.	No. 2.	No. 3.	No. 4.
Water,	9.7	8.2	7.4	7.6
Specific gravity,	1.273	1.280	1.245	1.251
Volatile matter,	45.0	48.9	48.3	48.2
Carbon,	50.3	66.7	45.1	48.7
Earthy matter, slightly ferruginous,	4.7	4.4	6.6	3.1
	100.0	100.0	100.0	100.0

Dr. Helfer states the river to be navigable to the coal, but that only by means of rafts during the rains for five months of the year.

Captain McLeod ascended by water to within 8 or 9 miles of the coal; when, finding the stream too shallow even for a small raft, he continued the journey by land to the Siamese town Thian Khan, and from thence to the coal, crossing several small rivers which discharge themselves into the Thian Khan on the banks of which the coal is found.

Abstract of Coal on the Thian Khan a branch of the Little Tenasserim River.

District.	Field.	Locality.	Beds.
Little Tenasserim, ...	Thian Khan River, ...	Near the Village of Thian Khan, ...	Several beds, 6 feet thick and upwards.

First Outlay.

Coal in Loco,		800
Depot at ditto,		400
Depot at Mergui,		2000
Jetty and Quay,		1000
Scales and Weights at the Depot,		500
Buildings for the Superintendents,		5000
Instruments, Spades,	400	400
Pickaxes,	100	100
Crowbars,	40	40
Trucks,	400	1200
Unforeseen expenses,		2000
		13440

To this must be added the expense of making a direct road through the jungle.

The removal of impediments in the river, chiefly the trees shutting up the passage, which expenses it is impossible to calculate, they can not however be great if convicts are employed.

CUTTACK COAL DISTRICT.

139. Extensive beds of coal are situated on the Bramini river and one of its tributaries, in the Gopalpashad district. The Bramini enters the Bay of Bengal near the mouth of Hoogley, not far from Point Palmyras. These beds would appear to deserve both from their position and extent, more attention than they have received, but the Committee have left nothing in their power untried with a view to improve their information on the subject.

140. *Talchergurh.* Seams of coal appear on the banks of a small nullah called Balajora, half a mile from the Fort of Talcheer, where a bed 18 inches thick, has been found within 13 feet of the surface. Beneath this a grey rock occurs containing as well as the shale above adverted to, characteristic impressions of plants of the coal formation. The coal is said to be of a good quality and glistening lustre, and to alternate with thin beds of shale.

141. From Talcheer, coal may be transmitted at all seasons in ten maund boats to Kumalung, 6 miles distant. From thence to Hunsuah on the coast it may be transmitted for six months of the year in boats of 100 to 300 maunds, where it may be laid down at three annas per maund, allowing two annas per maund for carriage. Hunsuah affords a safe anchorage for large sloops at least during the N. E. monsoon.

Gopalpashad, Sunjurra or Hingolee.

142. Fourteen miles from Talcheer, on a tributary of the Bramini river which bears one or other of the above appellations, coal is exposed extensively on both banks, projecting to an average height of 15 feet above the sand of the river for a distance of a mile.

The country between this and Talcheer is level, affording every facility for the construction either of a road or a canal. For the above particulars we are chiefly indebted to Lieut. Kittoe.

Abstract of Coal in the Cuttack Division.

Province.	District.	Field.	Locality.	Beds.
Orissa, ...	Bramini River,	Talchergurh,......	Balajora Nulla,.... ...	1 foot 6 inches.
		Hingolee, ...	Saugra Nulla, ...	15 feet, probably several beds of this size.

145. *Barracar River.* A bed of coal, 8 or 9 feet thick, is found on both banks of the Barracar river at Burmury.

146. *Damooda.* About 7 miles above the confluence of the Singharra nulla with the Damooda, and on a little nulla called Mooneah, the collieries formerly worked by Gilmore and Co., Mr. Homfray, as well as those of Carr, Tagore and Co., are situate I close together. The latter is called Ranee Gunge.

The bed worked in these three collieries is the same, 90 feet below the surface, and 9 feet thick, the superincumbent beds being sandstone and shale.

147. *Silmah.* On the Damooda river, five miles above Ranee Gunge, a deep pit is said to have been sunk with the intention of coming upon another bed of coal 7 feet thick observed in the vicinity.

In August 1841 a depth of 190 feet was said to have been attained. In this work six beds of coal were penetrated, each varying from 18 inches to 2½ feet in thickness.

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* The Barracara or Bunnoory coal.

thickness. *The vein is found on both banks of the Barracar river for some distance and over the Adji—it is succeeded by sandstone and soon afterwards wedges out against the schistose rocks, which form one immense mass of hills to Currukpore near Monghyr; returning to the Damoodah at the junction of the Singharun nullah, about 2 miles upwards, the first sandstone rocks are found on the banks of the river, but proceeding higher up this river to a distance of 7 miles to a little nullah named Nooneah, the collieries of Messrs. Gilmore and Homfray, and Messrs. Carr, Tagore, are situated close to and adjoining each other, the latter bearing the name of Ranee Gunge from its proprietory rights having been vested in the late Ranee of Burdwan, and it is from which circumstance the erroneous name of Burdwan collieries takes it origin, since it is not within many miles of the Burdwan district, the most appropriate name is the Damoodah coal valley.

The vein of coal at these collieries is about 9 feet thick and is won at a depth of about 90 feet, the superstrata being sand stone and black shale, such as is usually found to accompany the mineral in other countries—proceeding upwards there is coal found on the banks of the river but of worthless quality; and at Salmah, 5 miles higher up the river, a deep pit is sinking, and has been in operation for some years past with an intention of sinking down to another thick vein of coal of 7 feet, which has been ascertained to exist in another part of the country, in sinking this pit (at present August 1841) to a depth of above 190 feet, no less than six veins of coal have been passed through, varying in thickness from 18 inches to 2½ feet, but all of them [illegible] in quality, [illegible] expected that the main vein will be met after passing through one more vein of coal. Only one vein of [illegible] has been [illegible] in that pit—the strata are of sandstone, of very hard nature, similar in every respect to that in England which [illegible] and very dissimilar to that at the lower collieries before named. At 12 miles higher up at the China Coory colliery [illegible] 7 feet thickness, the same vein is found on the *both* banks of the river and is largely worked by Messrs. Carr [illegible] four different collieries—about 5 miles above China Coory is the junction of the Barracar [illegible] which place [illegible] traceable to the neighbouring mountain hill of Pachete, which is about 3 miles [illegible] throwing them not only out of their usual course but uplifting them so that [illegible] and which are found and worked up the Barracar river thence across the country [illegible] where for many miles coal and traces of it are found beneath the hills which [illegible] small rivers beneath those hills, but every where of very inferior quality [illegible] of igneous origin, the field in that country must always be [illegible]

At a few miles from the union of the Damoodah with Barracar [illegible] great faults above alluded to, and it has lately been commenced [illegible] veins hitherto worked and its thickness about 8 feet [illegible] brought to the navigable part of the river, the [illegible] of coal is extremely confined, [illegible] China Namore district [illegible] up the D[illegible] by a fault and where the whole extent of works [illegible] China Coory vein is found and worked by Messrs. Carr [illegible] above the union of the two rivers and where [illegible]

154. One of these tenders was at 6 annas, the other at 5½; yet [illegible] demand, it may be doubted if the average cost of Burdwan coal in Calcutta [illegible] 5 annas; and as 3½ annas go for carriage, we may perhaps conclude that with [illegible] than the present state of the Damooda affords, the increased demand for Burdwan [illegible] any very material reduction in price in Calcutta.

155. With regard to the coal trade on the Damooda, the [illegible] in the upper part of that [illegible] danger, risk, and uncertainty to which they give rise, are all incompatible with [illegible] should attend this branch of industry, so long therefore as the Damooda is the only [illegible] of enterprise directed towards the Burdwan mines must be comparatively limited.

The present difficulty of access being such as to deter new parties from [illegible] those already in possession of the field, the remedy would be to improve the [illegible] it.

1st. Either by a canal on the Adji.

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3rd. Or by railroad.

13.—Burmoory—Jugger[illegible] [illegible]arracar river, [illegible] collieries, the others being out o[illegible]

There are at and near to [illegible] Adji river, [illegible] inferior in texture and grain to th[illegible] [illegible]. Wh[illegible] stone ware are manufactured, and [illegible] for sale by [illegible]

154. One of these tenders was at 6 annas, the other at $5\frac{1}{2}$; yet notwithstanding the great increase of demand, it may be doubted if the average cost of Burdwan coal in Calcutta is now much, if at all below 5 annas; and as $3\frac{1}{2}$ annas go for carriage, we may perhaps conclude that without some better means of delivery than the present state of the Damooda affords, the increased demand for Burdwan coal cannot be attended with any very material reduction in price in Calcutta.

155. With regard to the coal trade on the Damooda, the floods in the upper part of that river, and the danger, risk, and uncertainty to which they give rise, are all incompatible with that steady improvement which should attend this branch of industry, so long therefore as the Damooda is the only means of delivery, the degree of enterprise directed towards the Burdwan mines must be comparatively limited.

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ADJI.

156 The first mines we come to on ascending the Adji river are situated 12 miles above Elambazar, or about 47 miles from the confluence of the Adji with the Hoogley at Cutwa. For a distance of 60 miles to the west of Elambazar, the country on both sides of the Adji river, is one extended coal field But it is not until we have advanced into the hills where the surface becomes broken and elevated, that the beds of coal are laid bare and exposed in ravines and other natural sections

157 *Churalya.* Situated on the southern bank of the Adji, at a distance of 60 miles from Cutwa. A six feet bed of coal here occurs within ¼ of a mile of the river A section of the place is formed by a small water course, shewing the coal to be covered by 13 feet of soil Beneath, it rests on 23 feet of sandstone, which becomes soft by exposure This sandstone is intersected every two or three feet by thin seams of coal and shale.

158 *Mahudnuggur* On the opposite or north bank, ¾ of a mile from the river and not above a mile from Churalya, a bed of coal 13½ feet, also exposed by a water course, is seen covered merely by 6 feet of hard clay.

159 *Mammudpore* Coal is worked by Mr Erskine in two places at Mammudpore, two coss south of the Adji Ghat at Seedpoorie.*

NOTE.

* To the west of this, the extent and quality of the coal improves, but we have no scientific particulars whatever as to the peculiarities of the different beds that have been penetrated Mines are now opened on the Adji side by the Dhoba Company, by Mr Erskine and by Mr Hollings and other parties, we believe under the denomination of Beerbhoom Coal Company

With regard to the quality of the Adji coal, it may be sufficient to state the result of two trials. Two hundred maunds of the Churalya bed were tried at the Mint, the result was that 23 maunds from this bed were found to be equal to 25 maunds of the best Burdwan *Vide Proc Committee, 11th January 1842, para* 3 From Mr Erskine's mine, 13 miles below Churalya. The daily consumption in a 20 horse power engine was found to be 27 maunds, 14 seers, leaving 24, per cent of ashes, 29 maunds 9 seers of Burdwan coal were required daily to keep the engine to the same work, leaving 25 per cent. of ashes *Vide Proc Committee 6th December 1841, para* 2

Boats of 200 maunds burden can ascend the Adji to Elambazar in the rains Beyond this the country affords every facility and excellent material for the construction of good roads

Plans have been suggested for improving the Adji river, but Col Forbes is of opinion that a canal 6 feet deep extended parallel to the stream would be cheaper *Vide Proc Committee, 4th October 1841, para* 8

Sixty miles of canal on the Adji river would save 200 miles in the carriage of Burdwan coal to the upper parts of Bengal, and 100 miles in the distance it is now carried to Calcutta. It would also obviate the necessity of keeping up a two years stock at Omptah to guard against contingent demands that might arise after the navigation of the Damooda closes, whereby the quality of the coal deteriorates. The saving of 100 to 160 miles of carriage, together with the loss and expense of depots, both estimated at 2 annas per maund, would allow of a toll to that amount on the proposed canal

The present expenditure of Burdwan coal may be estimated at 15 lakhs of maunds, which at 2 annas toll per maund would yield 1,25,000 Rupees per annum on the proposed canal for coal alone, which at 5 per cent would admit of an outlay of Rupees 25 lakhs or 41,565 per mile for a distance of 60 miles.

We do not take into account the other uses of a canal on this line but for the mere conveyance of coal alone, it is evident it would pay even at the present rate of expenditure But the expenditure has trebled itself within the last seven years and may go on increasing at the same rate, so that the return in seven years on coal alone might be reckoned with tolerable certainty to be 15 per cent. The great public benefit of such a work would consist in effectually opening the Burdwan district and destroying the present monopoly on the Damooda, which is directly opposed to public improvement in the supply of coal

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160. *Pariharpore.* A good deal west of the Mammudpore, only four miles from the Damooda and eight miles in a south westerly direction from the Adji at Durbadanga Ghat, Mr. Erskine works a bed of coal which rather belongs to the Damooda than the Adji basin.

Abstract of Coal in the Adji District.

District.	Field.	Locality.	Bed.
Adji River, ...	Churalya, ...	$\frac{1}{4}$ miles from the south bank of the Adji, ...	6 feet.
	Moheednuggur, ...	North bank of the Adji, [illegible] of a mile from the river, ...	$13\frac{1}{2}$ feet.
	Mammudpore, ...	Two coss south of Seedpore, ...	Size not stated.

RAJMEHAL.

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161. *Bansh River* At the pass of the Patchwarry on the Bansh river, 30 miles from its confluence with the Bhagarutty near Belgotta, coal has been for the last 30 years known to exist without eliciting any enquiry. Meanwhile the necessary supplies for the public Steamers in the vicinity are carried a distance of 600 miles at a heavy expense.

Doobradgepore On the Bramany river, 15 miles south of Patchwarry, coal is found in various situations for a distance of fifteen miles on both sides of the river It is still unexamined notwithstanding repeated urgent calls of the authorities on the spot for proper aid The Superintendent of the Nuddyah Rivers was suggested as a likely person to improve our knowledge on this subject from his vicinity to the place. He was therefore requested to visit the spot. See Proc. 6th January 1841, para. 15 the season being too far advanced before the request was communicated to him, he could only send persons out to make enquiries, the result of which would regulate his own movements, since which time however the Committee have heard nothing more on the subject.

NOTES

Letter from Mr James Pontet, to the Secretary of the Coal Committee, dated 10th November, 1838

I have the honor to acknowledge the receipt of your letter dated the 19th October, and herewith I send my reply to the different paragraphs.

To para. 1 At present only one bed of good coal has been discovered (in the Rajmehal hills) by me, 400 maunds of which has been forwarded to your Committee, and its arrival acknowledged by Captain Forbes under date 22nd September last, the above bed is 16 miles, from a navigable river four months out of the year

Para. 2 The best depot for the coal is at Coytah, 24 miles western from Moorshedabad on the Brammany nullah, accessible from June to September, for boats of 100 to 500 maunds burden Flat bottom boat would be desirable, but I think sufficient country boats from 70 to 80,000 maunds are procurable from Moorshedabad. I cannot at present state what will be the cost per maund, as it will have to go 16 or 20 miles by land, which I have not yet had a trial of; however I do not expect the coal will cost more than 6 annas a maund at Berhampore, it will all depend on what the land carriages costs, the boat hire is ten rupees per 100 maunds to Berhampore

3 No parties are engaged working coal mines in this neighbourhood, and the best mode of bringing the mine into operation would be I think first to discover the extent of the bed, the quality, and the actual cost per maund landed at Berhampore, with this information tenders might be invited to supply the different depots. The mine is so far from this station, and only to be visited by Europeans from December to May that I cannot give any more particulars until I go out, which will be next month If the Government will allow my son the pottah of the mine for its discovery I shall be happy to exert myself to obtain the above information, and raising as much coal as possible from January to May and send it to Coytah

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From the same to the Secretary of the Coal Committee, dated 22nd March, 1839

I have received your favor of the 29th January which I would have replied to earlier, but was in hopes to have had some satisfactory information to convey to the Committee Agreeable to my letter of the 29th December I proceeded to the mine and was in that direction all January, set the kuladies with boring rods at work, and found the vein to run to the N. W. of the Brammany nullee, (25 feet below the surface) The rods have not answered my expectations, they appear of too light a kind for a strata of stone; after the first vein of coal we came upon a hard black stone, and finding the operation of boring through it so very tedious I took upon myself to select a spot for a shaft and procured well diggers, and stone cutters from Narrapore, who have been the last two months at work, at present to all appearances satisfactory, as one of the men among the stone-cutters (who

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162. *Hurrah.* Detached masses of coal were collected on the surface at Teermohun and at Hurrah, and transmitted to Calcutta for trial in 1831; neither the circumstances nor the locality were described at the time. The only information to be gleaned from the correspondence on the subject is, that 1,000 maunds were transmitted to Calcutta, and fonnd to be unfit for steam.

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opened a shaft at Burdwan) says this mine bears the same resemblance to it, I am induced to peersevere a few feet more, in the hopes of coming to a useful vein, the first 23 feet of soil is red and black earth, mixed with kunkur (from sample 1 to 4) and under that, to the depth of 40 feet, are 13 different stratas (three of coal, and the rest various kind of stone) vide 5 to 17 (from the samples forwarded this day for the steamer passing Rajmehal) may be your Committee will be able to form an opinion whether it is likely I shall succeed in coming to a good vein. The last despatch made to you was at the mercy of natives entirely, the season being so far advanced when it was ordered, and it is more than probable to have had some from the surface, which your Committee complains of. I could from along the banks of the river (if required) procure five or six thousand maunds of good coal, but as I have discovered that the vein is of not sufficient depth to work, so I conclude your Committee would not wish it. Certainly no reliance can be placed upon my discovery, for the ensuing season; if I come upon a good and deep vein as expected in a few days, I shall extract as much as I can before the rains. The boring rods have been applied in seven different directions, and the vein appears to run more westerly than otherwise, unfortunately the two kulashies who accompanied the rods have both been laid up with jungle fever, which has retarded their operations greatly for the last month, they will commence again in a day or two, when I hope to be able to report how far the vein does extend, at present we have only found it 300 yards as from the river, and $\frac{3}{4}$ of a mile wide. I shall feel obliged if you will inform me, whether your Committee approve of my proceedings, and to what depth may I carry the shaft, the stone cutters inform me before they come upon the present vein (working at Burdwan) they had to penetrate through 30 feet stone. The expenses now incurred consist thus of

4	Stone Cutters,	22	0
15	Coolies for the shaft,	45	0
1	Sirdar,	4	0
2	Peons,	5	8
12	Coolies for the rods,	24	0
		100	8 per mensem.

I have paid to this date 607-11-4 on account of the coal mine, &c. and beg to enclose the account which I hope will be found satisfactory, by it you will perceive I have unexpectedly exceeded the sum sanctioned by your Committee, but being a trifle to gain such an object, I trust you will use your interest to get the balance sanctioned, also an additional advance should the Government wish the present operations to be continued. An early answer will greatly oblige.

From the same to the Secretary Coal Committee, dated 13th May, 1839.

I have wished to acknowledge the receipt of your favor the 4th ultimo before now, but owing to the dreadful sickness (jungle fever) in my establishment (four men having died) I have not been able to send those particulars I thought would be acceptable to your Committee. Shortly after the receipt of your favor I sent to forbid the men extending the excavation, which they had previously done from the water coming in too quick upon them. I had a "Mhate" at work, but it would not keep the well free, to admit of the men working, my want of experience in sinking a shaft properly has been a great bar to completing my discovery this season, the men are so sanguine that the vein is not more than two or three feet off, that after the rains I shall prosecute my attempt by making the well long instead of round, so as to admit of more men working. During the ensuing rains I hope to procure leave of absence to visit Burdwan, when I shall make myself acquainted with the different appearances of the strata above the vein in that quarter.

Agreeable to your Committee's request I have returned the boring rods (on the 4th instant,) addressed to Colonel R. Powney, expense of the boat hire and carting has been 23 Rupees, which I hope you will remit me at your earliest convenience, as well as the balance of the former account.

163 *Moot e Jarma* At the Village Mol rajepore near the Mootee Jarma or waterfall coal was f und and samples tran n tted to C lcutta in 1831 but r) descript on of the localit having been at the t e co muni cated recent atte npts to refind it have proved unsuccessful The coal was cons dered inf rior

Abstract of C al i the Rajmehal D str ct.

District.	Field.	Locality	Beds.
I jmel al	Bansh River	I atel arry Pass	I i sandstone
	Bram ny P ,	Doobradgepore,	Numerous beds not described alt rnat g with sandstone and shale.
	Teermol un	Hurra	Not traced
	S engully	Mootee Jarn a	Not traced.

Th e bel or feld of coal l as been traced a mil S W of the Brammuny ri er (n Belp ttu) a d I am incl ed to th n t s a co inuat n of that in B dwan. I lave likew e t a d t lo miles to the N W between the B an muny and H rrah where Cap a n Tan r some years ago opened a sl af I ro the diff re t pecime s of ea l coal and stone I f rwa de l you by the Steamer in March your Comm ee can nf r n me wh eth er I sh ould be succes ful in trac ng the vein if I proceed) the exca a on

Trial of Rajmehal Coal sent to the M nt by Dr McClella l on the 31st May 1841

The s eam l av n been got up in the f rst instance by English coal, and on the engine be ng started the f n g w h t e R mel al coal com n n e l and dur g the t me it was used the steam was kept up to full force the fire l ad a good blaze a l t e fire bars alm t l a l ng l t a l p t

The coal subm ed f r experimen t we gh ng 13 ma nds 3 seers 0 ch ttack worked the M nt 20 horse power steam en ne 2 h 30 m b g at the ra e of 4 maunds 21 seers 9 ch ta ks per hour against 3 maunds and 5 seers of the best Burdwan coal expe ded per l our o the same eng ne and work ng under s milar circumstances

(Signed) W N FORBES, *M nt Master*

2nd J ly 1841

R port on Mr Jo ts C l s nt to the M t by Dr McCl lland Secretary to the Coal and Iron Comm t ee on the 10 l Jan a y 184

The coal la r g bee tr ed at the Mint, 20 l orse power s am e e t was f nd t at t fa ed to keep up t e steam, and h conse u ence of the f qu t st ppage of the e g t bee m n es a e t d nu t e exp riment. T e coal a ea s g a y inf r o r n qual y to t at sent at a pre ous period to t e M t by M I n t

(Signed) W N FO BES M t Master

7th F bru ry 184?

PALAMOW.

164. Within 30 miles of the Soane river and about 100 miles in a direct line from the confluence of that stream with the Ganges, numerous beds of coal exist. They all lie in the valley of Palamow. The coal districts in the vicinity of this valley are as follows:

I. Hotar, in the upper part of the valley.
II. Singra or Sidra, in the middle part of the valley.
III. Gorossan Nulla, 5 miles beyond Chapari.
IV. Rajhara, on the Sodabah Nulla.

NOTES.

Extract of a letter from Mr. W. B. Tytler, Superintending Engineer Steam Department, dated 22d September, 1839.

The only obstacles to the free navigation of the Soane may be summed up in a few words, viz. Currents to ascend against running 12 miles and upwards an hour, with channels cross, variable, and tortuous, eddies wheeling in all directions, and the water in this river constantly rising and subsiding, as it is more or less affected by the mountain torrents and the overflowing of its tributary streams, in the higher ranges of hills in Palamow. These obstacles are to be considered by no means insurmountable; but the time consumed in ascending the Soane with boats of any considerable burden, will act as a serious drawback to the profitable navigation of this rapid river.

Regarding the local situations where I experienced the greatest difficulties in ascending the Soane, I beg to submit that between Maneah and Daudnaghur the stream was so strong as frequently to defy our united efforts to get ahead at all: and I was obliged on several occasions to call in the aid of the villagers to pull up the vessel with ropes. This plan answered very well where good footing was obtained on any of the high banks: but when obliged to trac on sands in following the channels, the boatmen became tired and dispirited by getting into quick sands, and in consequence my progress upwards was the more retarded as their fears prevailed. From Daudnaghur to the Benares Road we had a rise of the river: but being favored with a slight easterly breeze, this compensated for the increase of water, although our progress upwards was not at a more rapid rate than the foregoing days.

From the Benares Road to Bundoo Ghaut, the river subsided, and the breeze freshening at the same time our vessels made more way: but the river rising again as we moored the Amirkah chain of rocks at Bundoo and the stronger currents setting direct over them, I deemed it advisable to take the eastern channel, being the safest of the two: but even through it, I was obliged to warp up with the light anchors of my Pinnace, the anchors being carried ahead by my Pilot Dinghee. This is the most rapid part I met with on the Soane, it is not so much owing to the declivity of the bed of the river, as to the water being confined into a narrow space, by the obstruction of the rocks on the western bank, extending out nearly to the middle of the river's bed. From Bundoo Ghaut to the mouth of the Coyle, although so short a distance, owing to the sudden subsiding of the Soane, we experi-enced much difficulty in getting out of the upper end of the eastern channel, partly for the want of water, but chiefly owing to the undefined nature of its numerous inlets and its broad shallow entrance. On the 27th August just as I had entered the mouth of the Coyle about 4 P. M., I determined on proceeding on up the Coyle in my 200 maunds Dinghee.

The average depth of the water in the Soane I found to vary from 6 to 20 feet; and at no part, so far as I have seen, would a steamer have the slightest difficulty of navigating this river as high as the Coyle, provided she had power to steam the rapid currents.

I found the water in the Coyle between its junction with the Soane, and Garia Ghaut, flowing at about the same rapidity as that of the Soane, and the same remarks apply generally regarding cross currents and eddies, but so uncertain is its rises and falls, and so sudden and frequent do they take place, that no certain depth of water can be found in its channels throughout the rainy season. From Garia Ghaut to Mangeowah, and thence to Seeckseekie, and Mangean, villages on both sides of the river, the Coyle runs over a rocky channel at an increased rapidity, and to an extent about one-third of the bed of the river; but the other two-thirds lying higher along the south-west bank, the water is wholly confined to this rugged course, to navigate through it is a difficult task as it is at present; but if the chief rocks now in the way were removed by blasting, no other obstacles whatever is found to prevent or obstruct navigation on the Coyle as high as Shapore, 6 miles above Singrah in Palamow.

The beds are of good workable size, some of them are large and situated on the banks of the Coyle river or its tributaries. The quality of the coal as far as it is known is heavy and inferior, but from some beds it is better, and from others very good

The Hotar bed, situated in the upper part of the valley is the least accessible access to it being intercepted by a range of hills which interrupt the navigation of the river for some miles. This is the more to be regretted as the bed thus placed is of unquestionable superiority

The other beds in the middle and lower parts of the valley are all within reach of water carriage, with more or less difficulty perhaps for a distance of 15 to 20 miles.

I The Upper Palamow, or Hotar Coal.

165 *The place at which coal was first discovered in Palamow, is indicated on Arrowsmith's large Map on the west bank of the Coyle river, at a point 50 miles from the conflux of the Soane. Major Sage who visited the place in 1830, found the coal to be in every respect like that of the Gorossan rich and bituminous. Iron is found extensively with the coal, and the country where uncultivated, is covered with extensive forests of saul, some of the trees measuring 14 feet in circumference The country is also rich in cattle used for the transport of grain, so that there is nothing wanting Major Sage remarks but roads and water carriage to render Palamow a rich district.

NOTES

Extract of a letter from Capt H Sage dated 2[?]th April 18[illegible]

In visiting the place marked "coal mine" in Bennel's Map No 8 I found a village called H[illegible] and at some distance up the Barra river an extensive bed of coal in every respect the same as the bituminous coal in the Gorossan, lay exposed to the eye In the neighbourhood of the coal beds, grows the saul. I measured one tree which at three feet above the ground was found to be 14 feet [illegible] inches in girth and which rose from 40 to 50 feet without a branch. Iron is found in great quantities, as also numerous granites Extensive mangoe topes with other signs of villages and cultivation, [illegible] had once been [illegible]ably peopled.

The country is rich in cattle, particularly in a small breed of sheep like the [illegible] for wool, [illegible] from the country are consequently in request grain on bullocks is exported in considerable quantities [illegible] wheat and barley were selling at 100 seers for the rupee the rivers abound in trout and other fish and nothing is wanting [illegible] Palamow a [illegible] and a manufacturing country but roads and a water communication direct with the Ganges

To bring the coal into use I would propose to throw a stone bund across [illegible] reservoir across the Coyle at Gana Haut, basing it on the gneiss rock, [illegible] stream I would propose a cut across the table land into the nearest [illegible] and locked all the way to the Futwah bridge below Patna—this would [illegible] a considerable saving to Government.

Another way to get down the coal &c would be to blast the rocks [illegible] river and give it during the rains a free communication with the Soane [illegible] Ganges [illegible] A young Engineer should be sent to survey the country and [illegible] bringing the resources of that extensive tract of country into [illegible] be trifling

The advantages accruing to the Government from the [illegible] depopulated; and yielding little or no revenue [illegible] from their inaccessibility will be brought [illegible] and the arts once introduced into Palamow [illegible] Sirgoojah and readily open for themselves, a passage [illegible] intended by our late Governor General Lord Wm. [illegible]

Abstract of Coal at Hotar in the Upper Palamow Field.

Province.	District.	Field.	Locality.	Bed.
Palamow,.........	Upper part of the Valley, ...	Palamow Village,...	50 miles from the conflux of the Soane,	3 feet 9 inches.

appears to be a stone coal. There are traces of vegetable impressions upon the top of the coal, but I was unsuccessful in obtaining any kind, either in the sandstone or the shale The valley abruptly terminates and opens into a woody plain of some miles in extent, in traversing which the shales and the coal are found all the way round to the foot of the high mountains towards the S E. in the direction of Tikoo From the summit of these hills a fine view of the valleys is obtained, and the marked difference in the shapes and appearances of the sandstone formation from that of the surrounding hills of primary origin is finely observable Ironstone is here found in abundance close to the village of Baumundya, in the Daouree Nuddee, in veins of 3 and 4 inches each, these veins are also found in the ravines all the way to Pohea Agar and at which place there are a number of iron melting furnaces upon the native plan Iron is here sold generally at 2-12 to 3 Rs. per maund of 48 sicca wt seers—it is in lumps of 4 to 5 lbs. each and has undergone the process of hammering and remelting four times at the time of sale The ironstone which I found under consumption had been previously roasted and was afterwards put into the little furnace made of clay, and bellows similar in all respects to that described in the Gleanings of Science for October 1831 Of the quality of this fine vein of coal I shall say little, the quantity of residuum or ashes was small and extremely light, but the difficulty in igniting the coal is considerable This coal even if worked would have to be conveyed away on bullocks, as the only practicable present mode for the reasons before advanced. Here then we have a noble field of coal extending 5 to 6 miles in breadth towards the south west and proceeding over an immense extent of country, I know it exists for many miles beyond the Burwelia, and I think we may fairly identify it with that found in Singhboom from its constant occurrence along the Coyle river in the upper end of that stream It seems extraordinary that the Damoodah coal field should also be traceable all the way up to this same range of hills, passing Ram Ghur and many other places of note, where it is found and from some samples of coal from the west of Ram Ghur, I am led to expect as the coal approaches those hills, that its quality very much deteriorates. The extraordinary fact of the gigantic reed whose impressions we constantly discover in the carbonaceous strata, is here found growing in luxuriance I have brought some whose roots were actually extended 4 feet into the coal bed. This is only example I know of the living reed being found near to coal.*

* N B The reed alluded to by Mr Homfray turned out to be only a grass, *Saccharum spontaneum*, which grows very generally throughout Bengal. No grass or glumaceous plant we believe, is found in a fossil state in coal.

II. Singra or Sidra.

166. On the N. E. bank of the Coyle river, at a distance of about 35 miles in a direct line from its confluence with the Soane, coal occurs in two situations.

Singra. At this point the Amanath river falls into the Coyle, intersecting several beds of coal from 1 foot 6 inches to 6 feet in thickness.

That which it was proposed by Major Sage in 1830 to work, is decribed as a non-betuminous coal, or anthracite, 4 feet 7 inches thick. Mr. Homfray who subsequently visited the place in 1837, describes the bed as only 3 feet 8 inches thick and of limited extent, and inferior quality.

It is overlaid by several thin beds of sandstone and shale with one thin bed of coal 13 inches thick.

NOTES.

Extract of a Letter from Captain W. Sage, dated 27th April, 1836.

The subject of a supply of coal being one just now of great interest, I purpose giving you a slight sketch of the country abounding in coal bassets in and around Palamow, I passed into this country in January 1830, crossing the Soan at Bundee Ghat, nearly opposite to Rotas Ghur and obtaining the left bank of the Coyle or Coel river at Manjian, leaving Guroo I re-crossed the Coyle and encamped at Singra or as in Map Sidra. The Amanath river joins the Coyle about 100 yards west of Singra. In its course it has cut off a portion of a hillock 1200 × 100 × 40 and the following section is observable.

	Feet	Inches.
Earth, Clay, Pebbles, &c.,	11	6
Shale,	0	11
Pebbles,	3	7
Coal No. 2,	1	6
Sandstone conglomerate, increasing in compactness as it descends,	8	0
Non-bituminous Coal No. 3, or Anthracite,	4	7
	30	1

This coal rests on a blue sandstone, readily splitting into tables or large flags, depth not ascertained, it is a good useful coal, burns to a soft white ash, without flame. It was traced nearly three miles up the Amanath. From 12 to 1600 maunds were sent to Dinapore and used in the smitheries, and in brick-burning, answered well.

Extract from Mr. J. Homfray, Report dated 10th July, 1837.

Upon glancing over the Map of the Coyle river which falls into the Soane and which accompanies this memoir, there will be seen at a distance of about —— miles from the Soane and on the right or east bank of the Coyle, a tolerable large river, which falls into it near to the village of Singra.

At the mouth of this river is the Amanath coal field. Commencing immediately at the junction with the Coyle river we have a sandstone and at a very short distance up the river are seen on the west bank, first a vein of coal 3-8, and a little above it, another of about 3 feet, which is however divided in its centre by a band of stone of 8 inches, thus dividing it into two veins. This coal is opened to-day for about 600 yards in length, when from its declining or dipping, it sinks below the river; on the banks of earth also is found another small vein of coal but which is better seen on the opposite side of the river where there is a high sandstone rock and the coal vein in full view, it is also seen in several other sites in the river for about one mile distant, where it is terminated by a large basalt dyke, and thus ends the coal on that side or up the Amanath. Near to where this little coal is seen, under the rock there is a small Nuddee, which is called Junjunsree, falling into the Amanath, and having its rise about 7 or 8

167 Mr W B Tytler, Civil Engineer employed in Steam Department having visited Palamow in 1839, reported the existence of a 6 feet bed of coal a little above the village of Murall near Singra, and states the extent of the coal beds there to be quite inexhaustible See Proc. 5th August 1839, para. 7

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miles distant under the high hills to the east. Up this little river the upper vein can be traced some distance—but in no place is there more than a few feet of rock over it, it is consequently soft and tender, and the sand stone rock is scarcely deserving the name of rock being more a sandy conglomerate—stretching to the N and E the ground is very full of ravines and the crop or outburst of this coal is every where found so that in fact there appears to be but little covering over it. To the east the traces are cut off by an immense number of small earthy hillocks among which the sandstone and crop coal is found and then it seems to terminate but on the N side it runs rather a greater distance underneath the little village of Bulserah and Seguat, where all traces are lost of coal Around this circle of coal is found and at a distance of 2 miles on the west and south and on the direction of the rise of the vein sandstone and underneath it the usual ironstone measures in which are two remarkable fine veins of iron ore—the measure is 14 feet in thickness the upper vein varies from [illegible] to 12 inches and even 14 inches in thickness and at 4 feet below it is another vein in balls of ironstone 5 or 6 inches and in large oval balls, such exactly as are common in Europe Beneath this is a sand stone and at some distance below it, a black aluminous shale of which the cattle are said to be remarkably fond and when sick will of their own accord go to several well known places in order to lick it with their tongues. Beneath it is found a sand tone and quartz and then syenitic quartz, and then the passage is into masses of granite boulders. This ironstone has but a very little covering over it, and it is seen in every little ravine around there and in the nullahs which fall into the Amanath and [illegible] rivers as well as the Doorgatty Nuddee and Soodaban and down the Coyle river to nearly opposite the village of Rampore and Lanjooree This ironstone is the extreme boundary of this mineral district the coal at one corner of it being contained within a very limited circle the ground being all around here gently undulating and no where having many feet higher than the river bed Near however to the Bulserah village there is one spot which indicates a little better appearance as to solidity and should the coal prove to be really worth pursuing I should continue to sink a pit, which is already marked out as near to a peepul tree (the only one thereabout) and the reason which would make me believe it to be the most eligible spot is, that the little or upper vein of coal being thereabout 20 feet below the surface (by calculation) that having all the veins one over the other the bottom or main coal might probably be there found more solid than what it has proved at Singra, or at the opening higher up the river The field would however be very limited, as the great number of ravines materially decreases the quality of surface and probably 200 to 300 beegahs would be the extent there being two dikes perceptible to the eye which somewhat tends to increase my hope of its extent being greater than what is stated These ravines are more numerous on the south side towards Murall but the ground towards Seguat has the appearance of being tolerably even and undisturbed I have alluded to the quality of the coal hitherto obtained as very inferior in fact it scarcely appears to have been consolidated and there is in this formation of sand tone and coal something so very unusual that I must dilate on it to shew that the nature of the coal is imperfect and that we can scarcely hope to obtain any thing better from a formation which to me appears to be so recent and imperfect. Should however contrary to my expectation the coal prove chemically of value it may then be worth while to continue the sinking of the pit marked out near to the peepul tree but otherwise I should scarcely think it worthy of pursuit

The order of the Strata is thus

Surface		Ft. In.	
Sand tone		20 0	This is merely a conglomerate [illegible] particularly at the bottom
Coal		1 4	
Shale		0 10	
Sand tone		18 0	This is very soft and [illegible]
	Ft. In.		
Coal,	0 10	3 2	Very [illegible]
Stone	0 8		
Coal	1 8		

Abstract of Coal near the Village of Singra.

Province.	District.	Field.	Locality.	Beds.
Palamow, ...	Middle District,...	Singra or Sidra, ...	{ Singra Village, ... { Above Miral Village,	{ a, 13 inches. { b, 4 feet 7 inches. 6 feet.

		Ft.	In.
Shale, ...		30	0
Sandstone, ...		8	0
Coal, ...		3	8
Shale, ...		3	0
Sandstone and [illegible], ...		60	0
	Ft. In.		
Sandstone measures, { Shale, ...	5 0		
{ Iron stone, ...	1 0		
Shale, ...	4 0	11	0
Iron stone, ...	0 6		
Shale, ...	3 6		
Sandstone, ...		12	0
Aluminous Schist, ...		3	0
Sandstone, ...		12	0
Quartz and beneath it Granite.			

This sandstone is remarkable for the number and size of pebbles, increasing in size downwards, until they actually occur in *contact with the coal,* and that too when there is one vein of coal superimposed over the other. I know of no *other instance of such a conglomerate—the pebbles on the* coal are some of them 1 to 2 lbs. weight, and those in the upper sandstones appear to be of the same genus, although they must have been so fixed at different ages.

Now this extraordinary occurrence of pebbles in a series of rocks lying one over the other with intervening veins of coal, is something to me new. Of single conglomerates there are many instances, but here the pebbles seem to have subsided through the sandstone, when it must have been in a semifluid state as it will be seen by the specimens that the largest pebbles are at the lowest part of the sandstone and that they *gradually decrease in size upwards*, until the upper portion of the measure, is but a coarse gritty sandstone. From this very extraordinary circumstance I infer, that we cannot hope for any very solid ground hereabouts, and without it, I fear that any mining operation would be very hazardous, and from the want of solidity in the rock, would be attended with constant danger to the colliers. Should however, these objections prove futile, the situation being within ½ mile of an excellent ghaut, where the coal could be laden on to small boats proceeding down the Coyle river to the Soane, would be extremely favourable.

Extract of Proceedings of the Coal Committee, dated 5th August 1839, *para.* 7.

Received *a report of Mr. Tyler, announcing the discovery of a bed of coal* on the Amanath, near the village of Miral, and close to Singra, the place visited in 1836 by Mr. Homfray. The bed is said to be of good quality and inexhaustible, six feet two inches in thickness. The specimen forwarded to the Committee appeared to be a dull slaty coal.

III Gorossan Nulla.

168 On the Gorossan Nulla, (which we cannot find laid down on Maps to which we have access) Major Sage in 1830 discovered a highly bituminous coal of very superior quality The locality at which the coal occurs is not described. Two beds are intersected at the same spot which is stated to be about five miles beyond Chapari. The uppermost bed is only 13 inches thick the lower one which is separated from it by 1 foot of shale and 1 foot 4 inches of sandstone, is 3 feet 9 inches thick and said to burn with a cheerful blaze in an open grate

Abstract of Coal on the Gorossan Nulla

Province.	District.	Field.	Locality	Beds.
Palamow		Gorossan Nulla,	5 miles beyond the village of Chapari,.	a. 13 inches. b 3 feet 9 inches.

NOTE.

Extract of a letter from Captain H Sage dated 2[illegible]th April, 1836.

I passed through Shapur Champur Chandas and Chapari, about five miles beyond which I found coal beds on the Gorossan nullah or river entirely different from those of Singra. The coal is very bituminous, burns with a clear bright flame and makes a cheerful fire in an open fire grate Section of the bank of the Gorossan river

	Ft.	In.
Earth, Sand, and Gravel,	8	0
Sandstone	6	4
Shale (bituminous),	1	0
Sand tone	2	1
Coal No 1	1	1
Shale	1	0
Sandstone	1	4
Coal No. 2	3	9
Total,	24	[illegible]

IV. *Rajhara.*

169. Mr. W. B. Tytler reported in a letter dated 22nd September 1839, the discovery of a distinct coal basin near the village of Rajhara 10 miles north of Singra, and consequently within 25 miles in a direct line, of the Soane river. He was led to this discovery by the numerous fragments of coal he found in the Ladabah nullah. He traced these fragments for about 8 miles from the confluence of this nullah with the Coyle, when he came upon a vein 9 inches thick.

Since then, Mr. C. B. Taylor an Agent of Messrs. Carr, Tagore and Co., or the Bengal Coal Company, has established a mine at this point.

We have understood Mr. Taylor to state the bed of coal here opened, to be *six feet.*

Abstract of Coal in the Rajhara.

Province.	District.	Field.	Locality.	Beds.
Palamow, ...	Lower portion of the Valley,	Ladabah River,...	Rajhara, ...	*a*, 9 inches. *b*, 6 feet.

Extract of a letter from Mr. W. B. Tytler, Steam Department, to Captain J. H. Johnston, dated 22nd September, 1839.

I beg to report a new coal basin which I discovered while passing through the jungles between Seeckie and Singrah on the 6th instant. This field is near a village called Rajharah, about 10 miles due north from Singrah, on the Ladabah nullah, I traced this field of coal by the fragments of coal I found on the sands of this nullah, which I explored 8 miles from the banks of the Coyle where the basin is situated. The vein of coal is only 9 inches thick and quite in the bed of the nullah, the banks of which are thickly covered with jungle. The quality of the coal is about equal to that of Upper Miral, which it resembles more than any other coal I have seen in this country.

THE CENTRAL COAL DISTRICTS.

170 So called in this report from their being situated beyond the influence of navigable rivers and coasts.

They are as follows

I Ramgurh
II Chotessgurh
III Singrowlı.
IV Surgooja.
V Sohagpore.

Although situated beyond reach of the great lines of navigation, the resources of these districts are calculated to effect improvements of the most important nature when properly directed.

The facilities they will afford in the first instance in furnishing all the material that can be requisite in the construction of roads, must go far in determining the scale, and the direction of such works throughout the tracts in which such valuable resources occur

The two first it will be observed, extend in a direct line between Calcutta and Bombay, presenting abundant supplies of coal, and of iron materials along the line for a distance of 360 miles. The third and fourth fall equally within the direct line from Calcutta to Mirzapore, and with the fifth into that between Mirzapore and the Nerbudda. The greater portion of three most important lines would thus be supplied with all the requisite materials on the spot, for the construction of the most improved roads. The coal these central districts afford, has in most instances been found of a very superior description.

These districts being more or less elevated, their climate is consequently exempt from many of the objections to the plains, and the manufacture of iron on a small scale by the people, indicates a disposition on their part for manufacturing pursuits.

I Ramgurh.

171 *Bullea.* About 30 miles west of the coal districts of Burdwan and Adji, and 14 miles south of Hazareebaugh, coal occurs about a mile or so from the village of Bullea, on the banks of the *Sancherae*, a tributary of the Hakaroo Nulla. The bed is stated to be 3 feet in thickness, and of considerable extent.

Balam Again about 30 miles to the left of the trunk road from Calcutta to Benares at a place called Balam, extensive beds of coal have recently been discovered by persons employed in making a road from Chota Nagpore and Hazareebaugh, the coal resembles that of Burdwan. The road crosses over the beds.

About half a mile to the east of these last, beds of coal were observed of very promising quality, and great extent. The following are the results of analysis of three samples from these beds, recently received from Lt. Col. Ouseley

	No. 1	No. 2	No. 3
Sp. Gr.	1.31	1.19	1.29
Carbon	61	53	60
Inflammable matter	27	31	32
Ash	12	16	8
in	100 parts.	100 parts.	100 parts.

NOTES.

Extract of a letter from Mr. Assistant Surgeon William Dunbar dated 23rd February 1841

On the banks of the Sancherae, a small nullah running into the *Hakaroo* I first saw the coal in a bed about 3 feet in thickness with a [illegible] inclination to the west. It was [illegible] very black [illegible] below a friable [illegible] and [illegible] containing kunkur. The bed seemed to be of great extent, and I have no doubt that any quantity of coal can be procured at the place

172. At Angballa, about 43 miles east of Hazareebaugh, close to the 187 mile-stone on the new Benares road, a bed of coal occurs in a nullah on the right side of the road proceeding from Calcutta. The bed is said to be large.

Abstract of Coal in the Ramgurh District.

District.	Field.	Locality	Beds.
Ramgurh, ...	Bullea, ...	In the Suncheraie, a tributary of the Haharoo, ...	3 feet.
	Badam, ...	Within 30 miles of the Benares Road, ...	Several large beds.
	Angballa, ...	On the right hand side of the new road from Calcutta to Benares near the 187 mile-stone.	Size not stated.

At *Bullea* there are large and very extensive iron works, employing a great many persons, and yet strange to say, though most of the inhabitants are aware of the existence of this extensive coal bed, they never use it for their furnaces, but are at great expense in transporting wood and charcoal from the forests, several miles distant. I endeavoured to impress upon some of the workmen how advantageous it would be, and what a saving would accrue to them were they to use this coal, but by their answers they evinced their utter indifference to the subject, and their determination to adhere to the customs of their fathers. The coal bed is not above a mile distant from the works.

Extract of a letter from Lieutenant Col. J. R. Ouseley, dated 16th August, 1841.

Coal is well known to be abundant in Pachete, and some 7 or 8 years ago it was discovered on the old road from Hazareebaugh to this, by Lieutenant Richard Ouseley, the Assistant to the Commissioner: it was some where near Ballia, one march from Hazareebaugh. I am happy to say I have in making the new road, found an immense field of coal, about 9 or 10 miles south of Hazareebaugh, of which I shall do myself the honor of sending a specimen; the best is in a nulla a mile off the road, it nearly equals some anthracite coal I discovered in the Hoshungabad district some years ago, which was declared by the Bombay Committee to be better than any other coal, Scotch or English (I believe 84 per cent); I sent down 200 bullock loads, and it was tried on board a steamer; this coal would, I think, prove on digging a little deeper to be just the same; there would be no greater difficulty in removing it than from Palamow, where there is a great quantity of coal of the Pachete kind.

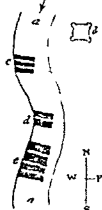
Extract of a letter from Col. Ouseley, to F. J. Halliday, Esq. dated Chota Nagpore, 31st December 1845.

When I made the road between this and Hazareebaugh, at a place called "Badam," they had to cut along the southern slope of an ascent rather deeply, when a large field of coal was found: this was of the same description as that called Burdwan coal, but to the east of it about a mile, I found on examination some beautiful coal, of which I send a specimen. It is only second to that I discovered at "Bénar," in "Hushingabad," in 1834-35. Coal of this kind, will do more than double what the Burdwan (Pachyte) coal does, has little ash, and I think would not leave much scoria on the bars of the furnace. In a few days I purpose proceeding again to the place; I have no doubt that this coal will coke as well as that of "Bénar," a desideratum of much importance, as Indian coal has not been found to coke (so says Dr. McClelland) with the exception of that at "Bénar."

The coal I now send is superficial, on cutting deeper into the mass, which is not in thin strata as is usually the case, but of vast thickness, I am convinced it will prove as good as any Welch or English coal. It is also as well that I should mention that iron is now made close to where this coal is, but with *charcoal.*

II Chotessgurh, Berar Rajah's Country

173 On the Hutsoo* river, a large branch of the Mahanuddee, great beds of coal occur a little to the south of the Fort of Koorba. The bed of the river for a distance of 716 yards, appears to be composed of alternate beds of white sandstone, slate clay, and coal. These rocks dip from 1 to 3½ inches in the foot. The annexed sketch exhibits the relative position of this coal to the Fort *a a* the bed of the Hutsoo river about 300 yards broad *b* the Fort, *c* bed of coal intersecting the river in the direction of W N W dipping N N E 1 inch in 12, and presenting an outcrop of probably about 100 yards *d* a bed called *coal clay* as marked on Col Ouseley's sketch, *e* a bed of coal dipping 1 inch in 11, and apparently from the sketch of Col Ouseley, 200 yards in *thickness*



The quality of this coal is stated to be very superior, although not yet established on analysis.

Although this coal is situated at a distance of 320 miles inland from Point Palmyras, yet the Mahanuddee is easily navigable to Sumbulpore within 100 miles of the coal it deserves to be considered therefore, how far the superior quality of this coal might render the Koorba beds worthy of attention for the supply of the coast.

Abstract of Coal at Chotessgurh.

Province	District.	Field.	Locality	Beds.
Chotessgurh,	Ruttenpore, .	Hutsoo River, .	Near the Fort of Koorba	*a* —? *b*, 200 yards.

NOTES

Extract of a letter from Lt Col Ouseley to the Secretary of the Coal Committee dated 16th August, 1841

I found coal also in the Huslah river at Koorba near Ruttunpore (in Chotessgurh) of a very valuable kind, and [illegible] by the river for a vast extent

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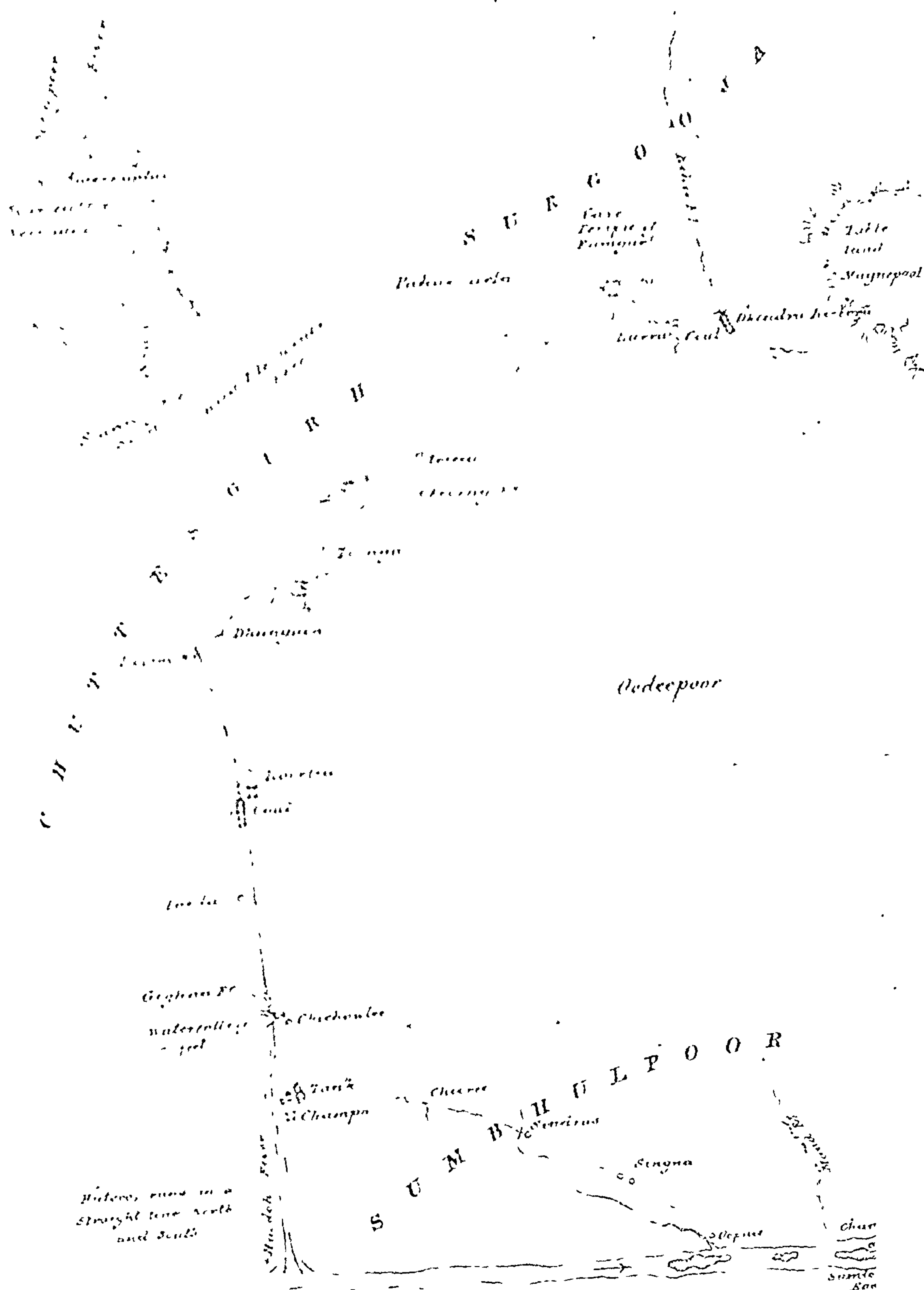
Extract of a letter from the same, to the same dated [illegible]

The Koorba coal could be sent down the Huslah* to the Mahanuddee [illegible] Sumbulpore where the boats could re ascend as often as the weather would permit.

At Chandlee on the Huslah where there is a small fall of 20 feet [illegible] another Coal Depot where the boats from Koorba to Chandlee [illegible] at Chandlee [illegible] there are no further obstructions to the navigation [illegible]

I have sent for some of the Koorba coal which you shall have [illegible] the field appears to equal in size [illegible]

* Or as it is named Huslah [illegible]


Oodeepoor
S U M B H U L P O O R
Table land
Coal
Tank
Champa

III *Singrowli.*

174. On the table lands at the head of the Soane fifty miles to the westward of Palamow, coal has been found in several situations.

Kotah.—On the Bulloa Nuddee a mile N. N. W. of the village of Kotah, four thin seams of surface coal have been found, varying in thickness from 6 inches to 14 inches.

The beds are supposed by Captain Wroughton (to whom we are indebted for what we know regarding them) to extend towards Burdee in the same district.

175. At a place called Lewallah Mookhe 8 miles S W. from Kotah, and 7 miles W. from the town of Sipore in the territory of the Rewah Raja, a bed of coal 1 foot thick occurs.

Abstract of Coal in Singrowli.

District.	Field.	Locality.	Bed.
Singrowli, ...	Kotah, ...	Mowzah, ...	6 inches.
			1 foot 2 inches.
	Sukhewon, ...	Lewallah Mookhe, ...	1 foot.

NOTES

Referring to Arrowsmith's Map, the Singrowlie coal at Kotah would seem to be situated as near to Chunar as the Palamow coal is to the Soane, or Burdwan to the Hoogley

Captain Wroughton adverting to this subject in a letter to the Revenue Board, 30th April 1840, remarks—"Many reasons induce me to believe that I can pursue the Kota strata to some situation adjacent to the Goput river, which forms a conflux with the Soane at the town of Burdee, from whence the coal could be conveniently and cheaply conveyed by a road uniting with the Mirzapore and Jubbulpore road"

The following indications of the existence of coal in the direction of Burdee are stated, the first on the authority of Captain Wroughton, the others on that of Captain Waugh It is not however to be understood that the *carboniferous* beds alluded to are coal, but something in the opinion of Captains Wroughton and Waugh usually connected with it.

1 In the Demarh nullah, which flows into the Goput at a point S 25 W. 27 miles from the town of Burdee, situated at the conflux of the Soane and Goput rivers, *carboniferous* beds are found

2 Again in the Goput river, at the village of Summurd, a distance of 37 miles S 25 W from Burdee, carboniferous beds occur

3 Again at two places about 4½ miles S. 25 W. from the last named

4 Again at Neoru, S 13 miles from Summurd, carboniferous beds are found.

5 At a place called Pipperah, 60 S W. 14½ miles from the Gd. Trg, Station Moreagurh, similar beds occur

6 Again at Koraree in the Kanuk Nuddee, 4½ miles south of the preceding, carboniferous beds were observed by Captain Waugh on the route from Amerkuntuk to Chunar, via Burdee

N B From the conflux of the Goput and Soane at Burdee town, this last point bears S 21 W., distance 69 miles to Moreagurh G Tr Station

IV. Surgooja.

176. On the western side of a high table land called Maynpat, situated between the tributaries of the Hutsoo and the Soane, coal of superior quality occurs in several situations.

The first is in the bed of the Rehar river, a tributary of the Soane, about 7 miles east from Burra on the road to Dondra. The extent of the coal is not particularly described, Col. Ouseley merely remarking that it is of very fine quality like that of Koorba, and in great quantity.

At Manpore, about 14 miles west and by north of Burra, and about 8 or 10 miles west of the celebrated hill temple of Ramgurh, a bed of superior coal occurs. The situation is further defined as 16 miles south of Cherghur.

Abstract of Coal in Surgooja.

Province.	Field.	Locality.	Bed.
Surgooja,...............	Manpore, ...	16 miles south of Cherghur, ...	3 feet.
	Reher River, ...	7 miles east of Burra, ...	Many yards thick.

Extract of a letter from Lt. Col. Ouseley to the Secretary of the Coal Committee, dated 16th August, 1841.

In the Rehar river, I found also great quantities close below the table land of the Mynpat, Surgooja.

Coal is applied to no use whatever by the natives. Indeed it was very singular to find that they were in every instance where newly discovered, ignorant of its being combustible ; accident one would have supposed might have given them that knowledge. I shall send for specimens of all the coal I know of as being distinct beds or fields, and of the iron ore, and forward them to you.

Extract of a letter from Lt. Col. Ouseley to the Secretary of the Coal Committee, dated 27th April, 1845.

The Koorba coal is much the same as that at Benar. So is the coal of the Rehar river.

—— Between Burra and Dondra Kishora in the Surgooja province west of the Maynpat, in the Rehar river, which falls into the Soane, there is very fine coal like that at Koorba, and easily got at.

V. Sohagepore

177 In the same parallel of latitude with Singrowlie and intermediate between that district and Jubbulpore, coal has been found of excellent quality in several places indicating so many great coal districts

A few miles N. W. of Sohagepore and at an equal distance from the Soane coal is reported on the authority of the late Major Franklin to exist but there would appear to be some doubt as to the precise locality and again it is said to occur three miles S. E. of Sohagepore at the junction of the Tipah with the Soane, but this locality is also doubtful.

178 *Keyverji River* About 2 miles from the junction of the Keyverji river with the Soane, and one mile from the village of Seetamadhi, the Keyverji river intersects a bed of soft black shale, at a distance of [illegible] yards from the east bank, in this situation coal occurs but to what extent is not stated.

179 *Johilla River* On the banks of the Johilla a feeder of the Soane near a place [illegible] S. W. from Palee, coal occurs. The two last localities have been communicated to the Committee by Dr Spilsbury on native testimony

Cheerdah. Coal is said to occur in the Rewah territory near Cheerdah but on what authority does not appear

Abstract of Coal in the Sohagepore and Nagpore Districts.

Province.	District.	Field.	Locality.	Beds.
Central Province,	Nagpore,	Soane,	N. W. Sohagepore	Not stated
	Sohagepore		S. E. Sohagepore,	Not stated.
		Keyverji,	Near Seetamadhi	Not stated
		Johilla,	Near Palee	Not stated.
	Rewah,		Near Cheerdah.	

NOTES

1 In the Pergunnah of Dhungewan district of Sohagepore at a point 2 miles E. by S. from the village of [illegible] the Keyverji Nullee which falls into the Soane at a point 5½ miles N. E. from the chief village of Dhungewan, an outcrop of surface coal is found of about 1 foot thick

2 Johilla Nullee at a point 6½ miles south east from Singurrah coal occurs with shale and a species of iron clay [illegible] 20 feet down the bank, thickness of the coal 1 foot.

The above is stated on the authority of Captain Wroughton. The following on that of Dr Spilsbury in a letter addressed to the Secretary of the Coal Committee under date 2d October 1840

The Keyverji and other specimens and papers relate to the sites of coal not very promising certainly, but without [illegible] the spots it is difficult to say what promise would be afforded of better—but it shows what an extensive coal field there is at a greater or less depth In the Johilla, a feeder of the Soane river near Palee, we met with traces as the specimens collected on a trip to Amarkantuk (which I am now sending down) will show—and again near Cheerdah in the Rewah territory

NERBUDDA.

180. The Nerbudda valley promises to be the nearest, if not the only direct source from whence supplies of coal are to be furnished to Bombay, from the continent of India.

Our limited knowledge of the Nerbudda, and the objections to the climate whether well or ill founded, are obstacles that may retard for a time the necessary improvements required to render the coal available.

181. There are difficulties however which from the necessity of overcoming them, seem to have been only intended as proper incentives to human enterprise. Of these perhaps the obstruction to the navigation of the Nerbudda is one, particularly as the coal of the Nerbudda valley is situated more conveniently with regard to Bombay, than that of Pensylvania, to New York and Philadelphia.

In the case of the Nerbudda, the difficulty would consist in evading the impracticability of the river by means of a rail road for a distance of 60 to 90 miles between Tullockwarra and Chiculda, which so far as we can glean from all official reports that have been made on the subject, would give 290 miles of improveable river.

The Nerbudda coal is 350 miles distant from Bombay, while that of Carbondale in Pensylvania is 250 miles distant from Philadelphia and New York, but in the former case we should only have a difference of level of about 2 feet per mile to overcome, while in the latter the Americans had an average of 9 feet 7 inches per mile throughout to encounter.*

182. The greater part of the coal in use at Bombay is, we presume at present the produce of English mines, and we know the P. O. Company depend chiefly on English coal for the supply of their large steamers between Calcutta and Suez. But whatever the resources of Great Britain may be in a mineral so essential to her own domestic improvement, they should not be unnecessarily drained for the navigation of the eastern seas.

This reason alone might be sufficient to warrant such arrangements as would render the abundant repositories of superior coal in India, available for the gradually increasing public wants.

183. Coal occurs extensively and of very superior quality in three different districts in the valley of the Nerbudda.

I. Gurrawarra district, on the Seeta Rewah or Sakar river, which falls into the Nerbudda about 70 miles above Hoosingabad.

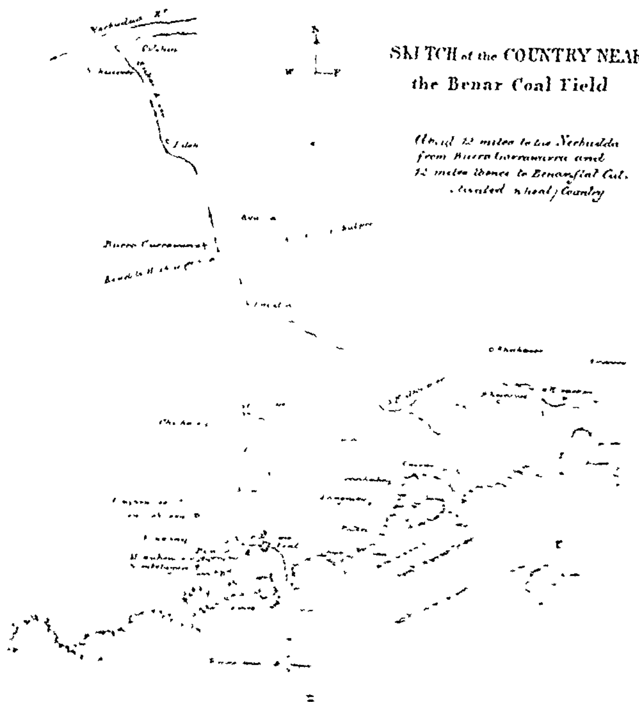
II. In the Baitool district, intersected by the Towah river which falls from the south into the Nerbudda at Hoosingabad.

III. At the head of the valley on the banks of the Nerbudda itself, near Jubbulpore.

* N. B. A report on this subject will be found in the records of the late coal Committee, some time since deposited in the Asiatic Society.

I. Gurrawarra.

184. The most important coal beds in the Nerbudda valley are situated in the Gurrawarra district, 70 miles above Hosungabad. Indeed they would appear from the notes of Col. Ouseley to be the most important in India not merely from their extent, but also on account of the superior quality of the coal. They occur at Benar on the Seeta Rewa river, a branch of the Sukur which falls into the Nerbudda river in the Gurrawarra district from the Mahadeo hills, on the south side of the valley.



185. The Benar coal is exposed on both banks of the Seeta Rewa river, at a point where that stream issues from the Mahadeo hills. The Seeta Rewah flows from thence through a rich cultivated plain a distance of 12 miles to the town of Gurrawarra, where it joins the Sukur which falls into the Nerbudda after a continued course of 12 miles more, through the same rich flat country. The whole distance from the Nerbudda to the coal mines at Benar being 24 miles, with a cart road the whole way.

It would appear from the annexed notes of Lt. Col. Ouseley, that there are three beds of coal in this locality of 20 feet, 40 feet, and 25½ feet in thickness respectively, covered merely with

1st. Sandstone 5 to 6 feet.

2nd. Good Coal 3 feet.

3rd. Quartz Sandstone 1 foot, after which come the three successive beds of coal of the dimensions above stated.

NOTES.

By Lieutenant Colonel Ouseley. Benar, discovered 4th January 1845, centre of the bed examined, as far as 40 feet thick, right bank 20 feet thick, left bank 25½ feet thick.

Benar coal exposed by action of the water 84 yards wide, and 127 yards 12 inches long the river.

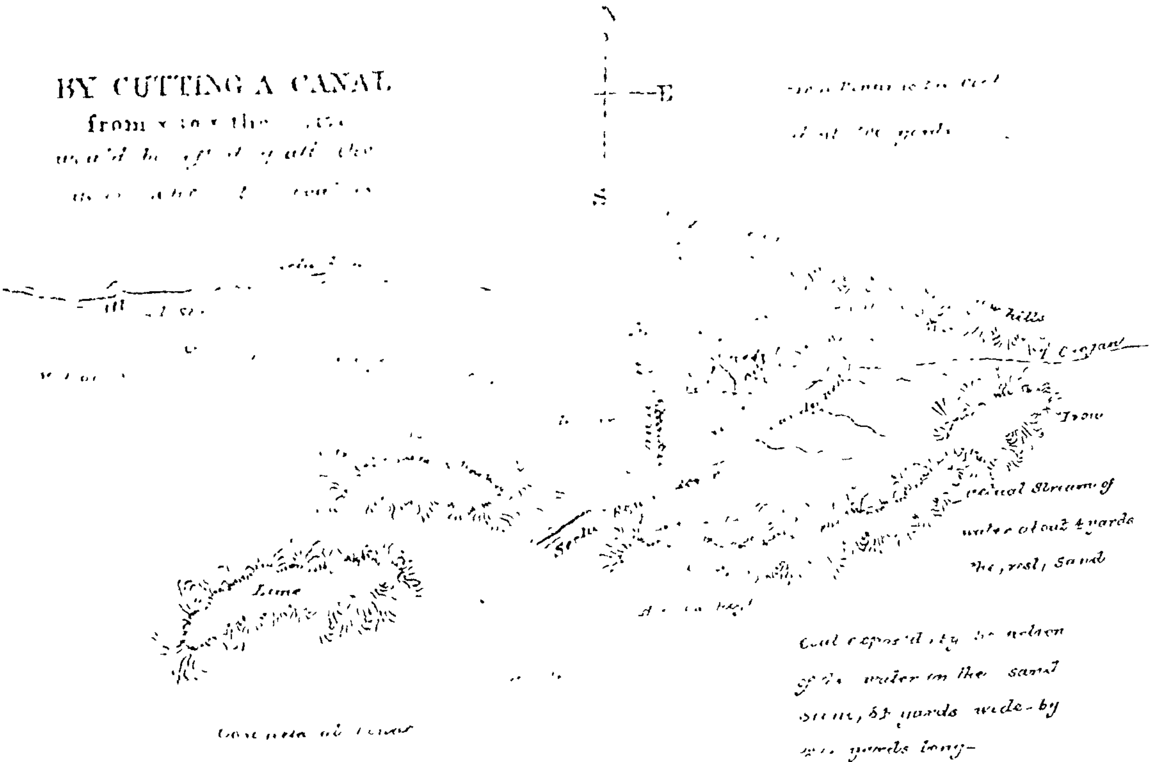
Sandstone,................ ... 5 *to* 6 *feet.*

Good Coal, ... 3 *feet.*

Quartz Sandstone, ... 1 *foot.*

30 *or* 40 *feet* in the centre bed of the coal 83 per cent. better than the Scotch coal tried on the Indus Steamer at Bombay.

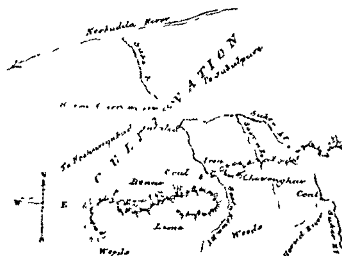
Reported by Colonel Wood, Secretary Bombay Government, 29th June 1839. I could not ascertain how thick the lowest bed of coal was, more than 40 feet.



186. *Kotra.* On the Hard river, one of the tributaries of the Sukur, 20 miles to the eastward of Benar, three beds of coal were found by Col. Ouseley, the largest of which is 4 feet in thickness. These beds are situated near the confluence of the Hard with the Sukur.

Abstract of Coal at Gurrawarra.

District.	Field.	Locality.	Bed.
Gurrawarra, ...	Seeta Rewa River, ...	Benar, ...	*a*, 20 feet. *b*, 40 feet. *c*, 25½ feet.
	Kotra, ...	Junction of the Hard with the Sukur Rivers, ...	*a*, 1 foot. *b*, 2 feet. *c*, 4 feet.



By excavating, no doubt the 24 miles from the coal to the Nerbudda would admit of conveying the coal by water. But it is to the Railway I look for the removal of the coal. For the Bombay and Calcutta line should actually commence here, where the iron is produced. (This is the only coal that cakes as the way the Welch coal does *in long heaps*) and along the base of these hills, the railroad should run, they are a continuation of the "Mahadeo" hills or "Sasunchul," and extend away west, under different names to Asseergurh. In Rajaborang and the Relybest hill, coal is found, pieces having been brought in to me, but I never visited the locality. Ever since 1836 I have thought it advisable that this coal should be first applied to smelting the ore (iron) making it into rails and laying them from the mines towards Bombay and Calcutta at the same time.

189 *Boragurh* At Boragurh near Mardanpore, two small beds of coal were found by Col Ouseley, one of them 21, and the other 12 inches thick.

190 *Sonadeh.* Eight miles south of Bhoorda on the Bhoorna river, (one of the tributaries of the Towah) coal occurs on both banks—neither the number, size or other peculiarities of the beds at this locality being mentioned

Abstract of Coal in the Baitool District

District.	Field	Locality	Beds.
Baitool, ...	Shawpore, .	Mardanpore, . .	6 feet
		Boragurh, ..	1 foot 9 inches.
			1 foot.
	Bhoorna River, ...	8 miles south of Bhoorda,	Size not stated, from 9 inches to 2 feet thick

III *Jubbulpore District.*

191 Coal occurs at the head of the valley, on the banks of the Nerbudda itself, of very superior quality, and in extensive beds, as far as they are known.

192 *Lemata Ghat.* About 9 miles from Jubbulpore, a very large bed of coal, many yards in thickness, crosses the bed of the Soane obliquely near Lemata Ghat. This coal is of first rate quality, see 77 in the Analyses of Indian coals. It is quarried in small quantity by the European residents at Jubbulpore from the bed of the river, where it is left dry after the rains.

193 A second bed occurs 400 yards lower down the stream, also of large size, but the quality of the coal is said to be soft.

194 In the station of Jubbulpore coal has also been found at a depth of 70 feet, thus proving the existence of extensive coal formation in this vicinity *

Abstract of Coal at Jubbulpore

District.	Field	Locality	Beds.
Nerbudda, ...	Jubbulpore,	Lemata Ghat, .	12 feet.
		400 yards lower down the River, ...	6 feet
		Cantonments at a depth of 70 feet, ...	Not traced.

NOTE.

* Lieut. Col Cox, 59th N. I. forwarded to the Agri Horticultural Society, specimens of a superior coal [illegible] from the Nerbudda, and which nearly corresponds in composition with Scotch Cannel coal. See 100 in the Analyses of Indian Coals.

CUTCH.

195. Forty miles from the northern coast of Cutch two thin seams of coal have been observed, varying from one to twenty inches in thickness. They are exposed by the bed of a river near Bhooj, between Seesugud and Koohee, at a place called Trumboo, and also at Doojapore.

196. No expense has been spared to follow up these indications, but without success; a depth of 190 feet was penetrated, chiefly through thin bedded sandstone of various colours, its texture changing to coarse and fine argillaceous, siliceous, and ferruginous, friable and hard, together with numerous layers of clay and pyritous iron ores, with a few layers of slate clay; and finally, at a depth of 190 feet, extremely fine particles of quartz, with an artesian spring of water were reached.

Abstract of Coal at Cutch.

District.	Field.	Locality.	Bed.
Cutch,.....................	Near Bhooj, ...	Doorjapore,.........................	20 inches.
		In the bed of the Trumboo R.,	Several thin seams.

Table of Indian Coals analysed in the Laboratory of the Hon'ble Company's Dispensary, from January 1839 to April 1846, in continuation of Prinsep's Table, Journal Asiatic Society, 1838, p. 177.

No.	Locality	Quality	Specific Gravity	Composition in 100 parts: Volatile matter	Carbon	Earthy and Ferruginous matter	From whom received
60	Moulmein, ...	Cannel Coal, . .	1.177	42.8	54.6	2.6	Mr Blundell, 7th May, 1839
61	Hoons south of [illegible]	[illegible]	1.32	36	49	15	Capt. Bogle, 1st June 1839
			1.3	40	55	5	Capt. Jenkins, 3d August, 1839
			1.26	44	50	6	Mr Tytler, Steam Department.
			1.48	32	58	10	Ditto specimen marked *Palamow*
			1.2	25	63 *	12	Ditto ditto 10th September, 1839
66	Mergue, ..	[illegible] excellent, ...	1.27	55	40	5	Mr Blundell's Assistant, Lieutenant Hutchinson, 27th August, 1839
67	Byrung Punjie Sylhet, .	Ditto, excellent, .	1.3	34	64.5	1.5	Major Lister, 4th September, 1839.
68	Ditto, variety,	Slaty, inferior	1.4	25	29	46	Ditto ditto ditto
			.....	30	50	20.	Ditto ditto ditto.
			1.3	51	42	7	Ditto 2d January, 1840
			1.5	32	57.5	10.5	Mr Ravenshaw January, 1840
			1.27	59.6	34	6.4	Capt Johnston, 18th April, 1840
			1.2	45	52.7	2.3	Lieut. Strong 24th June, 1840
			1.28	44	48	8	Ditto ditto.
			1.30	46.8	41.2	12	Capt Bogle July 1840
76	Khota, Singrowly, . .	Middling	1.29	51	32.2	13.8	Capt. Wroughton, 22d September, 1840
77	Jubbulpore, ...	Excellent, ...	1.49	50	47.1	2.9	Dr Spilsbury
78	Near Dearee, the Soan, ...	Middling	1.42	37.6	58.1	4.3	Mr Ravenshaw, 24th November, 1840
79			1.6	23.2	40.16	36.6	From South Africa, (Mozambique.)
80			1.72	62	28.26	9.74	Mr Blundell, February, 1841
81			1.375	64.6	24.4	11	Mr Sconce, April, 1841
82	Petchelee Gulf, ...	Anthracite, ...	1.71	20	74	6	Recd. through Capt. Johnston, April 1841
83	Doobrajgepore ..	Inferior Slaty Coal,	1.4	42	38	20	Mr Jas. Pontet May 1841
84	Jaipore, Upper Assam,	Superior, ...	1.3	48	46.2	5.8	Mr F. R. Hampton, 8th July 1841
85	Pulo Chermin Borneo,	Very superior, ..	1.34	64	32.5	3.5	Marine Board, 6th Nov 1841
86	Pulo Keng, Arreng Borneo, .. .	Inferior, ...	1.39	43	30.5	26.5	Ditto, 6th ditto ditto
87	Bikrampore, Cachar,	Superior, ...	1.3	64.8	33.2	2	Captain Guthrie, Engineers, 7th March 1842
88	Gulala River, Dhubary,.... .	Inferior, ...	1.4	37.4	24.6	38	Discovered by Mr Jas. Belford, Assistant Revenue Surveyor 1st Feby 1842, received from Major Jenkins
89	Bunarossee Caribari Hills, .	Brown Coal, burns freely, ...	1.4	50	40.6	9.4	Ditto ditto March 1842
90	Mirampara, or Balaj ra Caribari Hills, ...	Ditto, ...	1.2	64	26	10	Ditto ditto March 1842
91	Salkora, Caribari Hills, ...	Good Brown Coal, .	1.3 to 1.4	70	25.4	4.6	Ditto ditto March 1842
92	New Mine? Burdwan? .	Superior, ...	1.3	36	60	4	Major Henderson, [illegible] 1842
93	† Shouglae, (China),..	Very superior,	1.29	33.6	64	2.4	[illegible]

* The large proportion of Carbon in this Coal would render it an excellent [illegible] preponderates, while both might be had more reasonably at Dinapore than Burdwan Coal [illegible]

† Locality of the mine is about 15 miles from the mouth of a tributary of the [illegible] the former at a distance of 40 miles from the sea.

Table of Indian Coals analysed in the Laboratory of the Hon'ble Company's Dispensary, from January 1839 to May 1846, continued.

	Locality.	Quality.	Sp. Gravity.	Composition. Volatile Matter.	Carbon.	Earthy and Ferruginous Matter.	From whom received.
94	Near the falls of the Jamoona, (Assam),	Without exception the best specimen of Coal on the list, ...	1.2	46.	53.4	.6	Major Jenkins, 24th April 1844.
95	The bed of the Terro Nuddee, (Assam),	Superior, ...	1.3	62.	35.2	2.8	Major Jenkins, 26th April, 1844.
96	a. Nicobar Islands,....	Weathered Specimen,	1.3	61.4	34.2	4.4	Messrs. Mackay and Co. 27th May, 1845.
	b.		1.3	57.	40.	3.	
	c.		1.3	49.	46	5.	
97	Dikhoo, (Assam), ...	Most superior, ...	1.3	25	66.	.6	Captain Rogers, 25th Jan. 1845.
98	Diphoo, a tributary of the Jamoona, 8 miles above the falls,	A dull Earthy Coal, ...	1.3	44.6	38.8	16.6	Messrs. Masters and Wood, March, 1845.
99	Badam, ...	Very superior, ...	1.29	32.	60	8	Col. Ousely, December 1845.
		Good, ...	1.31	27	61	12	
100	Jubbulpore, ...	Cannel Coal, ...	1.3	59	37	4	Forwarded by Lt. Col. Cox to the Agri-Horticultural Society, and sent for Analysis by James Hume, Esq., 19th March 1846.

J. McCLELLAND, *Assistant Surgeon,*
Secretary Coal Committee.

Description of the annexed Map and Sections illustrative of the distribution of Coal in India.

No fact is better established than that coal was originally formed in small isolated or detached basins.

It is incorrect, perhaps, to say that the same bed may run to any very great or considerable distance, however appearances considered, without reference to full geological particulars, may seem to suggest such a conclusion. Lieut. Hutchinson, in his report on the coal beds of Arrakan, refers the veins observed at Bolonga and Sandoway, though 200 miles apart, to one and the same bed And Mr Homfray in a report on Palamow coal, dated 10th July 1837, states that it is traceable to Burdwan and Beerbhoom.

Such supposed connection is however, more apparent than real, and depends on the direction of mountains, rather than upon the original extension of the same bed, which can seldom be traced more than a few miles.

This fact in the history of coal, is of much practical importance. For however much the associated rocks may appear to be alike, we have reason to expect the local circumstances on which the value of the coal depends, to have something peculiar in them, in every situation in which it occurs

West of the Ganges the best coal is always either the deepest or most remote from water carriage There may be exception to this rule, but we know the Hazareebaugh, the Surgooja, the Sohagepore, and the Nerbudda coals, to be superior to those of Burdwan, Cuttack, Rajmehal, and Palamow

This we can explain from the fact which has been established by Mr Murchison and others in the history of coal, namely, that the main, or richest and best beds are always lowest in the series. Being lowest, they consequently require to extend a greater distance at an inclined angle before they reach the surface. Thus in the Section A B., Plate 2, the upper bed of Burdwan coal crops out at Serampore (*a*) when the lower or main coal (*c*) extends sixty miles further into the hills before it crops out.

Out-crops of coal are always arranged around, or on the flank of mountains or disrupted strata. Parisnanth is the base to which the Burdwan coal is inclined on the south east, and the Ramghur beds on the south, Palamow on the north, and Rajmehal on the east.

The high lands of Mynpatt would also appear to be the base around which the Surgooja beds are arranged.

There may be a difference of quality and appearance between the upper, or surface, and the lower, or main beds of coal, but still they both equally belong to the same formation

Captain Tremenheere was therefore doubtless in error in supposing the impression of plants he observed in the coal beds on the Great Tenasserim, to be those of recent plants.

So also is Mr Homfray most unquestionably in error in supposing the grasses he found growing over the coal beds of Palamow, to be those from which the coal of that valley were formed.

Were those observations correct, such beds could not belong to the true coal measures as we know they do, from the nature of the mineral itself, as well as from other minerals and fossils with which it is connected.

Section C. D Plate 2 represents the general level from Hingolee to the coast.

Section G. H. Plate 2, represents the same from Chotasgur to the coast. I. K. Plate 1, represents a general section of the coal formation from Sillhet to Upper Assam, which together with Section A. B. Plate 2, and all similar Sections throughout this report, are only to be regarded as affording a general idea of the subject, rather than a correct representation of the form and disposition of the beds.

The Maps will require no further description, as they either explain themselves sufficiently, or are referred to in the text.

A Skeleton Map, or Key, to the coal localities in India has been prepared in the Surveyor General's Office, by order of Government, the coal sites being marked on it from information on the records of the Committee, except the sites in Singrowlie, which are put down on the authority of Captain Wroughton.*

J. McCLELLAND,

Assistant Surgeon,

Secretary Coal Committee.

11*th July,* 1845.

* The Map in question, together with the Records of the late Coal Committee, have been made over to the Asiatic Society.

W. Ridsdale, Bengal Military Orphan Press.

Pl 6

MAP of the **COAL**

Formation at

Cutch 1845

CUTCH

Bhoj

Hussingabad

Pl 5

MAP of the **COAL**

Formation in the

Nerbudda 1845